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Feasibility Study of Hazardous Waste Management Options in Montana

Final Report

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FEASIBILITY STUDY OF HAZARDOUS WASTE MANAGEMENT OPTIONS IN MONTANA

July 1987

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SECTION 1

INTRODUCTION AND SUMMARY

SECTION ONE

INTRODUCTION AND SUMMARY

Introduction

Background

In 1976 the Resource Conservation & Recovery Act (RCRA) was passed by the U.S. Congress. This law was the first step on the national level to regulate the handling and disposal of hazardous wastes. In 1980 the U.S. Environmental Protection Agency (EPA) passed specific regulations concerning hazardous waste management. These rules established specific requirements for hazardous waste generators and transporters as well as definitions and identification of what materials are considered hazardous. Specific regulations concerning the requirements for hazardous waste disposal were approved two years later in July 1982.

RCRA provides that individual states may receive authorization of their state hazardous waste program, after which the state program operates in lieu of the federal program in that state. Montana was among the first states to seek final program authorization. Program delegation was received from the EPA on 25 July 1984.

In 1984 several amendments were made to RCRA. The most significant regulation substantially increased the number of establishments (businesses, industries, institutions, etc.) that are regulated. Before the amendments, only individual businesses, etc., that generated in excess of 1000 kg (2,200 lbs.) per month of hazardous wastes were regulated. Regulations formalizing the new amendment, which went into effect in September 1986, lowered the minimum quantity to 100 kilograms (220 lbs.) per month. The resultant impact of this amendment in Montana relates to several hundred businesses now having to fully comply with hazardous waste regulations where previously only approximately a dozen regulated generators existed.

Realizing that the new pending amendments to the regulations would require a large increase in the number of businesses that would have to comply with hazardous waste management requirements, the Montana Department of Health and Environmental Sciences (DHES) retained IT Corporation in 1983 to conduct a hazardous waste management facility study. The study centered around estimation of the quantities of hazardous waste generated in Montana as well as a preliminary evaluation of alternate management options for handling the state's hazardous wastes. The study determined that the two most logical options for

handling the hazardous wastes generated in Montana were as follows: 1) a central container storage facility whereby the wastes could be collected, stored and transported to an out-of-state hazardous waste facility since no in-state licensed hazardous waste facility exists, and 2) locate a hazardous waste landfill site in Montana. The study concluded that both options would be expensive to implement because of the small volume of waste generated in Montana. The study also concluded that the transfer concept should be considered the most economical method of the two options considered.

The IT Corporation study, coupled with additional research conducted by the Solid and Hazardous Waste Bureau's staff, led DHES to request financial assistance from the 1985 Montana legislature for implementation of a hazardous waste management strategy for Montana. Based on this request, the 1985 legislature appropriated approximately $800,000 to assist in the implementation of a hazardous waste management collection and transfer project.

Scope of Services

In February 1986, the DHES solicited proposals from qualified consultants to provide technical assistance for implementing the hazardous waste management project. In June 1986, the DHES entered into a contract with Environmental Resources Management, Inc., (ERM) of West Chester, Pennsylvania, and Damschen & Associates of Helena, Montana, to provide this technical assistance.

The technical assistance to be provided by the consultant for this project included the following major tasks:

1. Using the results of questionnaires and interviews and previously assembled data, identify the following for the hazardous wastes and used oil generated in the state:

    a) the waste types, quantities, and patterns of generation,

    b) the existing management methods used, costs, and problems related by the generators in the state and

    c) the existing management services and facilities that are available to Montana generators for these wastes.

2. Evaluate various technologies for the handling and disposal of hazardous wastes and used oils generated in Montana.

3. For the technology(ies) deemed most appropriate, conduct detailed evaluation of the services, facilities, and corresponding costs necessary to provide such a management

program(s) for the generators in Montana; make recommendations as to the most appropriate and cost effective alternative(s).

4. Evaluate various implementation strategies for providing the necessary facilities and services for the recommended waste handling system(s) and make recommendations concerning the most appropriate strategy.

To present the findings of the analysis conducted for this study, two final documents have been prepared. In addition to this document, the second report is entitled "Used Oil and Solvent Study for the State of Montana" dated July 1987. The information concerns used oils and the recycling of used solvents and was published in a separate report as a result of the following:

1) During the initial stages of the project, the EPA finalized its guidelines concerning the listing of oil as a hazardous waste; these final guidelines reversed the draft guidelines which had stated that used oil would be listed as hazardous. Since used oils are now not listed hazardous wastes unless they have been mixed with hazardous wastes and demonstrate the associated characteristics, the DHES and consultants decided to prepare a separate report evaluating the management of used oil in Montana; and

2) As a result of the inventory and analysis phases of this project, it was determined that a major portion of the hazardous wastes generated in the state are solvents. Also, it was clearly identified that the recycling of solvents can be accomplished more easily and economically than most other hazardous wastes. Finally, it has been the experience of the consultant in other states that mismanagement of solvents has resulted in the contamination of ground water at a great number of sites. Based on these reasons, DHES and the consultant also decided to address the evaluations concerning the recycling of solvents in this separate report.

The reader of this report is strongly encouraged to obtain and refer to the "Used Oil and Solvent Study for the State of Montana". This cross-reference should provide additional information concerning the management of used oils and hazardous waste generated in Montana.

<u>Summary of Findings</u>

Waste generation by three generator categories was analyzed in this study: Large Quantity Generators (LQGs), Small Quantity Generators (SQGs), and Very Small Quantity Generators (VSQGs). LQGs are those establishments which generate 1000 or more

kilograms of hazardous waste per month; SQGs generate less than 1000, but more than 100, kilograms per month; and VSQGs generate less than 100 kilograms per month.

Information on waste generation and management was provided by four sources: 1985 Generator Annual Reports, 1985 Annual Facility Reports, a survey of SQGs and VSQGs, and a series of interviews with generators of all sizes.

The Annual Report data indicated that 21 LQGs in Montana reported hazardous waste generation in 1985, generating an estimated 25,000 tons. Most of that waste - 94% - is treated or disposed of by the generator at on-site facilities. The remaining waste is sent off-site to generator-owned facilities in Montana (5%) or to commercial facilities outside Montana (1%). Of the waste shipped off-site for treatment and disposal, 80% consists of oily waste from the petroleum and refining industry; most of the waste treated on-site (99%) consists of various refining associated waste, much of which is landfarmed.

Extrapolated survey results for SQGs and VSQGs estimated that approximately 1200 tons of hazardous waste are generated per year by this group. Almost half of this waste is solvent waste. SQGs are estimated to dispose of 67% of their waste off-site, with 30% of this waste going to recycling, 22% being taken to a landfill by a contracted hauler, 20% being disposed of by sewer, and 9% being taken to landfills by the generator. VSQGs are estimated to dispose of 75% of their waste off-site, with 33% of this waste slated for landfill disposal by a hauler and 22% slated for recycling.

No licensed commercial hazardous waste disposal facilities currently exist in Montana. There are several firms that are avaiable to contract with generators in Montana to handle and dispose of their hazardous wastes. Interviews with generators indicated that total cost for disposal, including the estimated transportation cost, varies from $100 to $800 per drum. Costs per drum increased dramatically when quantities were small.

Re-evaluation of needed facilities in Montana required a re-examination of potentially appropriate waste technologies. Recovery, thermal destruction, treatment, disposal, and transfer technologies were evaluated. The quantities of waste presently generated in Montana, as well as various regulatory and institutional concerns, precluded the further examination of all types of technologies other than storage/transfer options.

Four storage/transfer concepts were evaluated: 1) collection with a Transfer/Storage (T/S) Facility, 2) collection with Staging Areas, 3) collection with direct transport to an out-of-state transfer, storage and/or disposal (TSD) facility,

and 4) Amnesty Days (a periodic collection service provided at no or little cost to generators). Operational feasibility considerations led to the exclusion of the direct transport and Amnesty Days concepts from further consideration. For the remaining concepts, potential market demand scenarios were developed in order that financial feasibility could be evaluated. The four scenarios selected to calcualte various levels of demand were:

1) all hazardous wastes from both SQGs and VSQGs would be collected;

2) all hazardous waste from SQGs only would be collected;

3) hazardous wastes, minus solvents, from both SQGs and VSQGs would be collected; and

4) hazardous wastes, minus solvents, from SQGs only would be collected.

These four scenarios represented calculated demands of 6192, 3744, 2923, and 2160 drums of waste, respectively.

Both the T/S facility and Staging Area options appear to be feasible compared to existing management costs incurred by SQGs, with the T/S facility option having slightly lower total cost per drum. This lower cost, in conjunction with various operational and educational advantages when applied to Montana, led to the recommendation of the T/S facility option for implementation in Montana.

Current Status

Interim Findings

In January 1987, the consultant prepared an interim report that summarized the findings and recommendations of the study. This information was correspondingly submitted and presented by the consultant to the Montana legislature at two hearings during the month of January.

The interim report summarized the quantities of waste, existing management conditions, the evaluation of processing and storage/transfer options, operational and financial strategies and preliminary recommendations. The preliminary recommendations included the following:

1) Implementation of a collection system and central transfer/storage facility with disposal of the waste at an out-of-state permitted facility;

2) Construction, and subsequent ownership, by the State of Montana of the central transfer/storage facility with the operation of the facility as well as collection and transportation systems contracted to private enterprise;

3) The State should proceed in the near future with the preparation of a bid package for the operation of the system; and

4) The State should initiate the siting, permitting, and design of the transfer/storage facility.

<u>Legislature and DHES Decisions</u>

Once the preliminary findings and recommendations of the study were released in January 1987, the DHES and legislature met on numerous occasions to determine if the consultant's recommendations should be implemented. After substantial discussion between the DHES, appropriate legislative committees, the Environmental Quality Council, and the Governor's office, the following decisions were made:

1. The State will not construct a hazardous waste facility at this time. Private sector hazardous waste management firms will be expected to fully service Montana businesses' hazardous waste management needs.

2. $212,000 of the remaining $632,000 of the 1985 legislative appropriation will be used over the 1987-1989 fiscal biennium to assist businesses and industry in minimizing or eliminating the amount of hazardous wastes they generate. The remainder of the funds will be appropriated to the General Fund. This assistance shall include:

   - waste stream/audit studies for selected businesses
   - continuation of waste exchange efforts
   - newsletters
   - fact sheets on regulatory requirements
   - joint industry studies
   - waste- or industry-specific information to assist individuals in identifying alternative technologies for managing wastes
   - seminars/workshops on waste- or industry-specific alternatives
   - compliance manuals to be used by small generators to assist them in preparing their wastes for disposal
   - public service announcements to inform the public of hazardous waste requirements and where to go for help

3. If the private sector fails to provide an adequate level of service, the department may re-direct a portion of the remaining funds toward the preparation of bid documents. The State would then advertise for bids to construct and operate a hazardous waste facility. The bid results would then be presented to the 1989 legislature for funding consideration.

SECTION 2

WASTE QUANTITIES

SECTION TWO

WASTE QUANTITIES

Definition of Hazardous Waste

Material first must be defined as a solid waste to be classified as a hazardous waste. Most wastes that are excluded from regulation as hazardous wastes are excluded because they are not solid wastes; for example, spent sulfuric acid used to produce virgin sulfuric acid is not a solid waste (when it is not collected speculatively), while spent sulfuric acid that is not recycled could be considered a hazardous waste.

Definition of a Solid Waste

Any discarded material that is abandoned by being disposed of, burned or incinerated, or recycled in certain ways, or is considered "inherently waste-like", is a solid waste; a solid waste can be a solid, liquid, semi-solid, or contained gaseous material. Hazardous wastes are a subcategory of solid wastes and are subject to the hazardous waste management requirements of RCRA.

Definition of a Hazardous Waste

A solid waste is a "hazardous waste" if it meets any one of the following criteria:

1. it exhibits one of the characteristics of ignitability, corrosivity, reactivity, or EP toxicity (see page 2-4 for a definition of EP toxicity);

2. it is listed in 40 CFR 261, Subpart D (See Appendix A);

3. it is a mixture of a solid waste and a hazardous waste and the mixture exhibits hazardous characteristics; or

4. it is a mixture of a solid waste and a listed hazardous waste.

Exclusions

EPA excluded several wastes from the classification "solid waste":

a. domestic sewage
b. industrial waste water discharges subject to the Clean Water Act
c. irrigation return flows
d. nuclear sources covered by the Atomic Energy Act
e. in situ mining materials
f. materials subjected to insitu mining techniques which are not removed from the ground as part of the extraction process
g. pulping liquors reclaimed and reused unless they are accumulated speculatively
h. spent sulfuric acid used to produce virgin sulfuric acid unless it is collected speculatively

EPA also identified certain solid wastes which are not regulated hazardous wastes:

a. household wastes
b. certain wastes which are returned to the soil as fertilizer
c. mining overburden
d. fly ash, bottom ash waste, slag waste, and flue gas emission control waste from the combustion of coal or other fossil fuels
e. drilling fluids
f. chromium wastes in which the waste is exclusively trivalent chromium
g. waste from the extraction, beneficiation, and processing of ores and minerals (including coal), including phosphate rock and overburden from the mining of uranium ore
h. cement kiln dust waste
i. discarded wood or wood products that are not EP toxic
j. waste samples for laboratory analysis

Sample materials are hazardous wastes when analysis and storage are no longer necessary.

Criteria For Identifying a Hazardous Waste

A hazardous waste is one which may cause or contribute to mortality or incapacitating illness or which poses a substantial

threat to health or the environment when it is improperly treated, stored, or disposed of or otherwise managed. EPA devised lists of wastes from nonspecific sources, specific sources, and chemical commercial products which are considered "hazardous" when discarded or off-specification; these lists are found in 40 CFR 261, Subpart D and are included for reference in Appendix A of this document.

Wastes may also be classified as hazardous by exhibiting a hazardous characteristic. The hazardous characteristics identified by EPA are ignitability, corrosivity, reactivity and EP toxicity.

Ignitability

An ignitable waste is one of the following:

1. a liquid (other than an aqueous solution containing less than 24% alcohol by volume) with a flashpoint less than 140°F (60°C) as determined by specified procedures; or

2. not a liquid, but capable under standard temperature and pressure of causing fire through friction, contact with moisture, or spontaneous chemical changes, and creating a hazard by burning vigorously and persistently; or

3. a Department of Transportation (DOT) ignitable compressed gas or a DOT oxidizer.

Corrosivity

1. an aqueous solution that has a pH less than 2 or greater than 12.5.

2. a liquid that corrodes steel at a rate greater than 1/4" per year.

Reactivity

1. substance that is normally unstable and readily undergoes violent change without detonating.

2. substance that reacts violently with water.

3. substance that forms a potentially explosive mixture with water.

4. substance that generates toxic gases, fumes, or vapors when mixed with water.

5. substance that is a cyanide or sulfide bearing waste which, when exposed to a pH between 2.0 and 12.5, can generate toxic gases, vapors, or fumes.

6. substance that is capable of detonating or exploding when subjected to a strong initiating source or if heated under confinement.

7. substance that is capable of detonation or explosive decomposition or reaction.

8. substance that is a forbidden, Class A, or Class B explosive defined by DOT.

EP Toxicity

An EP toxic waste is a waste whose filtrate, after extraction procedures (EP) testing, contains one of the contaminants listed below in excess of the given concentration. (When the filtrate contains less than 0.5% filterable solids, the waste itself is considered to be the extract for purposes of measuring contaminant concentration.) The EP test will be replaced by a more strict and comprehensive one, possibly as early as January 1988.

EPA HAZARDOUS WASTE NUMBER	CONTAMINANT	MAXIMUM CONCENTRATION (ppm)*
D004	Arsenic	5.0
D005	Barium	100.0
D006	Cadmium	1.0
D007	Chromium	5.0
D008	Lead	5.0
D009	Mercury	0.2
D010	Selenium	1.0
D011	Silver	5.0
D012	Endrin	0.02
D013	Lindane	0.4
D014	Methoxychlor	10.0
D015	Toxaphene	0.5
D016	2,4-D	10.0
D017	2,4,5-TP Silvex	1.0

* Maximum concentration is 100 times the Drinking Water Standard.

Categories of Generators

Hazardous waste generation by the following three generator categories was analyzed in this study:

Large Quantity Generators (LQGs)
Small Quantity Generators (SQGs)
Very Small Quantity Generators (VSQGs)

LQGs are those establishments which generate 1000 or more kilograms (2200 lbs) of hazardous waste per month; these generators have been regulated since 1980. The National Small Quantity Hazardous Waste Generator Survey[1] distinguishes between SQGs and VSQGs as follows: SQGs are establishments that generate less than 1000, but 100 or more, kilograms of hazardous waste per month. These generators have been regulated as of 22 September 1986. VSQGs are those establishments that generate less than 100 kg (220 lbs) per month of hazardous waste, and as of this date are not fully regulated. The same distinction is made in this study. Household hazardous waste is not included in the estimate of waste generation by VSQGs. Its pattern of generation is not established at this time, and reliable estimates are not available.

Large Quantity Generators

To determine waste generation by LQGs in Montana, the consultant reviewed three sources of data, two of which are the following: 1985 Generator Annual Reports, submitted by generators who shipped their waste off-site, and 1985 Facility Annual Reports, submitted by on-site treatment, storage, and disposal facilities (TSDs) as well as facilities which received off-site waste. These reports represent the most accurate information available to date regarding on-site and off-site waste treatment and disposal by this group of generators. The third source of data, personal generator interviews conducted after compilation of the data base, was used to verify large quantities of reported waste and current management practices.

The Annual Report data indicated that 21 LQGs in Montana reported hazardous waste generation in 1985, generating an estimated 25,000 tons. Most of that waste (94%) is treated or disposed of by the generator at on-site facilities. The remaining waste is

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[1]Abt Associates. National Small Quantity Hazardous Waste Generators Survey. February 1985.

sent off site to generator owned facilities in Montana (5%) or to commercial facilities outside Montana (1%).

Most of the waste shipped off-site for treatment and disposal (80%) consisted of oily wastes from the petroleum and refining industry. Other organic wastes, including solvents, accounted for 2% of this waste, while 5% were metal-bearing wastes and 14% were corrosive wastes. A complete breakdown of hazardous waste sent off site by waste type and quantity is presented in Table 2-1.

Most of the waste treated on site (99%) consists of various refining associated waste, much of which is landfarmed. A complete breakdown of hazardous waste treated on site by waste type and quantity is presented in Table 2-2.

Of the 21 LQGs that reported, 11 of them used only off-site facilities for waste treatment and disposal. Six LQGs reported using only on-site facilities, while 3 LQGs used both on- and off-site facilities. One LQG did not report any method of management. Off-site facilities used by Montana LQGs are presented in Figure 2-1.

Small and Very Small Quantity Generators

Small quantity generators are a major area of concern because collectively. They are thought to generate a substantial amount of hazardous waste, they constitute a large population of individual entities, and the potential for mismanagement of their wastes is high. Unlike LQGs, these small generators did not have to submit waste management reports previous to September 1986. Hence, very little specific information on those generators was available, and a small generator survey had to be undertaken.

The survey included both SQGs and VSQGs, since no distinction could be made when designing the survey. Data for both these groups will therefore be presented in this section. The objective was to survey all establishments in the state belonging to the 125 Standard Industrial Classification (SIC) codes identified by the US EPA as potentially containing significant numbers of small generators. The SIC codes and the 23 broader industrial categories to which they have been assigned by EPA (on the basis of similar market sector and waste types) are provided in Appendix B. In addition, a secondary effort was made to include all city, county, state, and federal government agencies in the survey. These government agencies were assigned to a new category created by the consultant for completeness. Information solicited by the survey included currently generated quantities

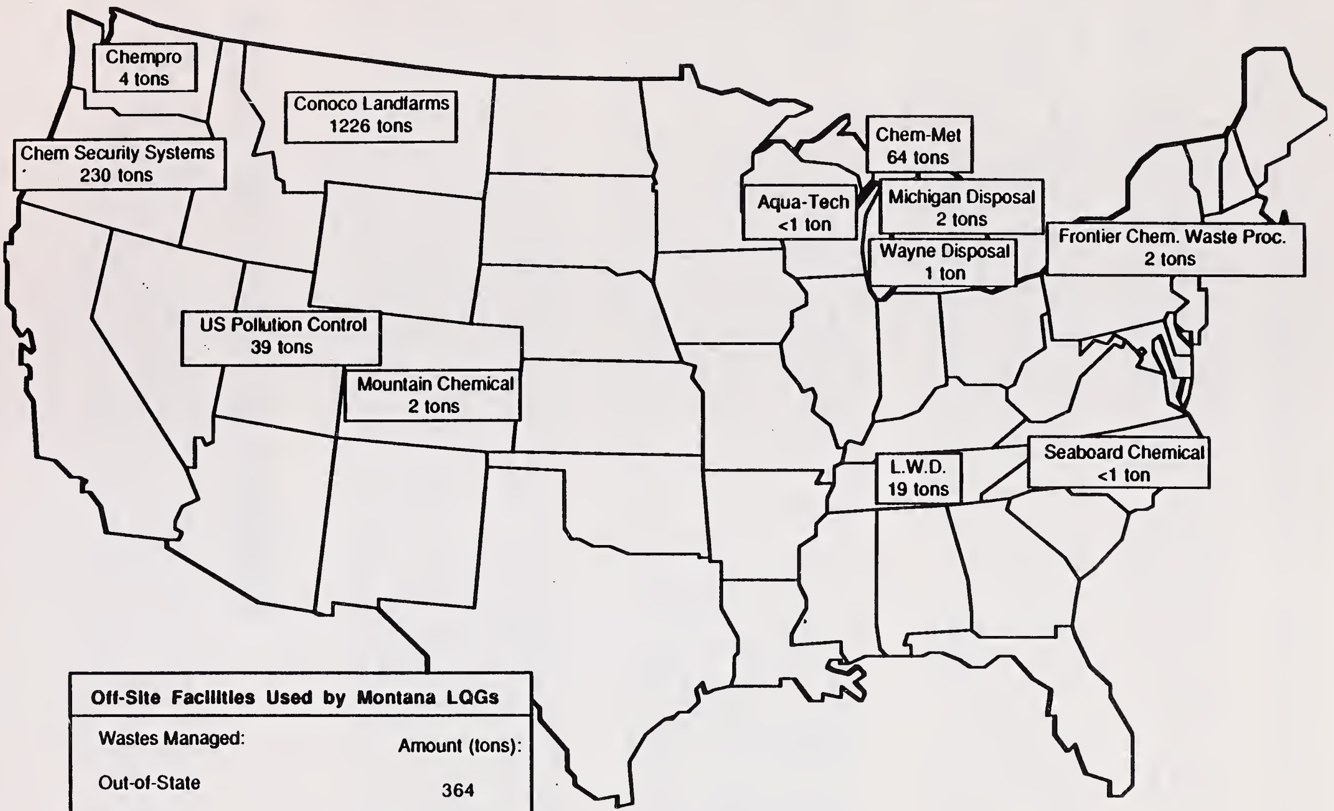
TABLE 2-1
MONTANA HAZARDOUS WASTE MANAGED OFF-SITE BY WASTE TYPE
(ANNUAL REPORT DATA)

EPA WASTE CODE	WASTE DESCRIPTION	TOTAL (TONS)
OTHER		1.555
D001	Ignitable	20.935
D002	Corrosive	201.888
D003	Reactive	0.002
D006	Cadmium	24.123
D007	Chromium	4.892
D008	Lead	19.494
D009	Mercury	0.029
D010	Selenium	0.100
D016	2,4-D	22.803
F001	Spent Halog. solvents - degreasing	0.912
F003	Spent non Halogenated solvents-still bottoms	5.908
F005	Spent non Halogenated solvents-still bottoms	0.210
F006	Waste water treatment sludge	0.458
K001	Bottom sediment sludge	29.700
K048	DAF Float	1180.00
K051	API separator sludge	61
K052	Tank Bottoms (leaded)	26.8
P004	Aldrin	0.001
P041	Diethyl-p-nitrophenyl Phosphate	0.104
P123	Camphene, Octachloro-toxaphene	0.002
U061	DDT, Dichloro Diphenyl Trichloroethane	0.020
U080	Methane, Dichloro-methylene chloride	1.605
U092	Dimethylamine(I), Methanamine, N-Methyl-(I)	1.324
U123	Formic Acid (C,T), Methandic Acid (C,T)	0.229
U151	Mercury	0
U211	Carbon Tetrachloride, Methane, Tetrachloro-	0.002
U220	Benzene, Methyl- Toluene	0.725
U230	Phenol, 2,4,5-trichloro-,2,4,5-trichlorophenol	0
U240	Acid, salts and esters	1.28
TOTAL:		1610

TABLE 2-2
MONTANA HAZARDOUS WASTE MANAGED ON-SITE BY WASTE TYPE
(ANNUAL REPORT DATA)

EPA WASTE CODE	WASTE DESCRIPTION	TOTAL (TONS)
OTHER		2.792
D001	Ignitable	4.263
D002	Corrosive	5.96
D003	Reactive	0.006
D007	Chromium	2.636
D009	Mercury	0.079
D010	Selenium	3.3
F001	Spent Halog. solvents - degreasing	7.924
F003	Spent non Halogenated solvents - still bottoms	0.837
F005	Spent non Halogenated solvents - still bottoms	1.165
K001	Bottom sediment sludge	16700.000
K048	DAF float	9.75
K049	Slop oil solids	4396.400
K050	Heat exchanger bundle cleaning sludge	0.700
K051	SPI separator sludge	935.4
K052	Tank bottoms (leaded)	211.100
U029	Methane, bromo- methyl bromide	0.005
U061	DDT, Dichloro Diphenyl Trichloroethane	0.02
U134	Hydrofluoric acid (C,T), Hydrogen Fluoride (C,T)	3.000
U151	Mercury	0.002
U240	Acid, salts and esters	261.037
TOTAL:		23512

Figure 2-1
Off-Site Facilities Used by Montana LQGs



Off-Site Facilities Used by Montana LQGs

Wastes Managed:	Amount (tons):
Out-of-State	364
In-State	1,226
Stored On-Site, Awaiting Shipment	20
In-State, On-Site (for comparison)	23,512

The ERM Group

of hazardous waste, as well as waste oil, and current management methods used.

A total of 8823 surveys were sent to potential small generators, of which 2039 surveys were completed and returned for an overall response rate of 23 percent. The resultant survey response, by industrial category, is summarized in Table 2-3.

In order to estimate state-wide hazardous waste and waste oil totals, a method for extrapolating the survey response was developed. This extrapolation method involved two steps. First, state-wide estimates of the total number of establishments in each industry group were determined using Department of Labor figures and number of returned surveys. Second, a "scale-up" factor was computed to extrapolate the surveyed quantities to these state-wide estimates.

Studies from other states have shown that extrapolation based on potential predictors of waste generation, such as the number of employees or value-added shipments, are of limited use because of a lack of strong correlation or lack of valid data. Therefore, a simple proportional scale-up factor was developed for each industrial category. The scale-up factor for each industrial group was derived by dividing the estimated total number of establishments in the entire state by the number of survey responses. The total quantity of each waste type reported in an industrial group was then multiplied by the scale-up factor to estimate state-wide total waste generation.

The resulting extrapolated estimates of hazardous waste and waste oil generation, by industrial category, are given in Table 2-4. Extrapolated estimates by waste type are given in Table 2-5. A summary chart of extrapolated waste quantities by generator category and major waste category is given in Figure 2-2. Separation of oils from hazardous waste and solvents from other hazardous waste is necessary in this study due to the present status of available management methods (recycling) for these wastes. Extrapolated estimates of hazardous wastes by planning region are presented in Figure 2-3.

Impact of Hazardous and Solid Waste Amendments (HSWA) of 1984 on Future Waste Generation

The 1984 Amendments to the Resource Conservation and Recovery Act (RCRA) represented the most sweeping changes to date of the Act. While the amendments themselves were adopted in 1984, many of the regulations implementing them them have only recently been or are currently being promulgated. The 1984 amendments therefore still

TABLE 2-3
MONTANA SMALL GENERATOR SURVEY RESPONSE RESULTS
BY INDUSTRIAL CATEGORY

	1	2	3	4	5	6	7
		Responses					
Industrial Category	Estimated No. of Establishments	No. of SQG With Waste	No. of VSQG[1] With Waste	Total With Waste (2+3)	No Waste	Only Empty Container Waste	Total[2] Response (4+5+6)
1. Pesticide End Users	23	1	3	4	2	0	6
2. Pesticide Appl. Services	189	3	11	14	17	15	46
3. Basic Chemicals Mfg.	8				4		4
4. Wood Preserving	9		3	3	0	0	3
5. Chemical Products Form.	8				4		4
6. Laundries	152	4	35	39	12	0	51
7. Misc. Services	219	1	9	10	40	0	50
8. Photography	68	1	6	7	16	0	23
9. Textile Manufacturing	2						0
10. Vehicle Maintenance	2712	19	376	395	151	23	569
11. Equipment Repair	351	2	16	18	79	2	99
12. Metal Manufacturing	120	1	17	18	18	1	37
13. Construction	586	4	62	66	33	8	107
14. Motor Freight Terminals	1		1	1	0	0	1
15. Furniture/Wood Mfg.	83		2	2	16	1	19
16. Heavy Metal Users	0						0
17. Printing and Ceramics	192	4	14	18	16	0	34
18. Cleaning Agents/Cosmetics	1		1	1	0	0	1
19. Misc. Manufacturing	29	1	0	1	7	1	9
20. Paper Industry	1						0
21. Analytic/Clinical Labs	158	2	15	17	36	1	54
22. Educational/Voc. Shops	261	1	36	37	52	5	94
23. Wholesale/Retail Sales	306	1	18	19	82	11	112
24. Government	393	10	90	100	3	20	123
* TOTAL	5,872	55	715	770	588	88	1,446

1 VSQG excludes zero generators and empty container only generators.

2 Of the 2039 respondents, 8 were excluded because of reporting errors and 585 were not in the 24 industrial categories. These survey responses represented 9% of the total surveyed quantity of hazardous waste and 5% of the total surveyed quantity of used oils.

TABLE 2-4

EXTRAPOLATED WASTE ESTIMATES (IN GALLONS) BY INDUSTRY GROUP

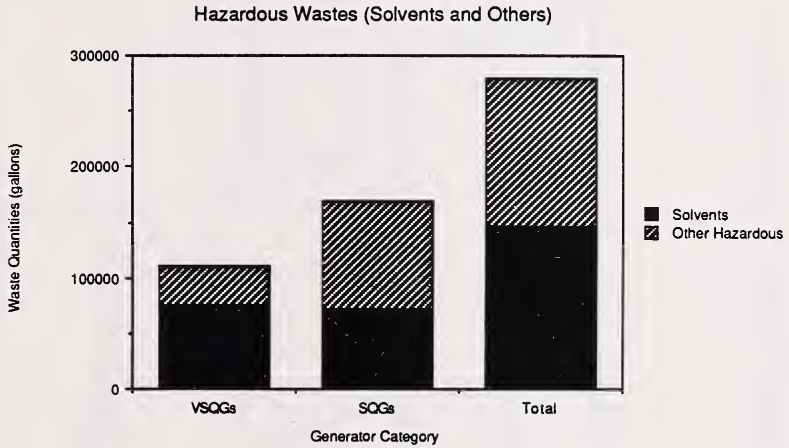
	SMALL QUANTITY GENERATORS					VERY SMALL GENERATORS				
INDUSTRY GROUP	TOTAL WASTE	OILS	SOLVENTS	HAZARDOUS WASTE	HAZARDOUS WASTE MINUS SOLVENTS	TOTAL WASTE	OILS	SOLVENTS	HAZARDOUS WASTE	HAZARDOUS WASTE MINUS SOLVENTS
CHEM. MFG.				0	0	0	0	0	0	0
CL. COS. MFG.				0	0	26	8	0	18	18
CONSTRUCTION	87406	65760	4384	21646	17262	77076	66801	7652	10275	2623
ED. VOC. SHOPS	1251		1251	1251	0	14845	12265	1796	2580	784
EQUIP. REPAIR	5581	1775	895	3806	2911	16444	13352	3060	3092	32
FORMULATORS				0	0	0	0	0	0	0
FURN. MFG.				0	0	961	874	84	84	0
GOVERNMENT	20327	12075	4377	8252	3875	26979	22538	2505	4441	1936
LABS	5362	879	879	4483	3604	4445	1058	1486	3387	1901
LAUNDRIES	4602		4602	4602	0	10196	89	10107	10107	0
METAL MFG.	3143	65	810	3078	2268	4194	965	1990	3229	1239
METAL USERS				0	0	0	0	0	0	0
MTR. FRT. TERM.				0	0	40	40	0	0	0
OTHER MFG.	1639		1629	1639	10	0	0	0	0	0
OTHER SERVICES	4380			4380	4380	1762	66	53	1696	1643
PAPER INDUSTRY				0	0	0	0	0	0	0
PEST. SERVICES	13286	2322	64	10964	10900	1981	321	21	1660	1639
PEST. USERS	1915			1915	1915	613	421	34	192	158
PHOTOGRAPHY	5624			5624	5624	1585	0	9	1585	1576
PRINTING	13222	311	4944	12911	7967	4806	209	339	4597	4258
TEXTILE MFG.				0	0	0	0	0	0	0
VEHICLE MAIN.	347318	264759	47438	82559	35121	1795949	1734909	46521	61040	14519
WH. RET. SALES	1365			1365	1365	18458	17379	164	1079	915
WOOD PRESERVERS				0	0	1095	0	0	1095	1095
TOTAL	516421	347946	71273	168475	97202	1981455	1871295	75824	110160	34336

TABLE 2-5
MONTANA WASTE GENERATION (IN GALLONS)
BY WASTE TYPE[1]

Waste	SQG		VSQG		TOTAL	
	Survey	Extrapolated	Survey	Extrapolated	Survey	Extrapolated
Waste Pesticides	1,470	2,859	348	743	1,818	3,602
Washing and Rinsing Solutions Containing Pesticides	4,825	14,015	2,250	5,122	7,075	19,137
Spent Taxaphene Solution or Sludges from Dipping			5	5	5	5
Other Spent Pesticide Solution NS/Sludges from Dipping			4	19	4	19
Dust Containing Heavy Metals	10	48	30	132	40	180
Washing and Rinsing Solutions Containing Heavy Metals	3,650	17,630	348	1,798	3,998	19,428
Wastewater Treatment Sludges Containing Heavy Metals	625	2,981	96	309	721	3,290
Waste Ink	604	3,414	12	44	616	3,458
Ignitable Paint Wastes Containing Flammable Solvents	2,597	10,652	3,007	12,561	5,604	23,213
Liquid Paint Wastes Containing Heavy Metals	833	3,182	689	2,873	1,522	6,055
Spent Solvents, N.O.S.	17,224	64,167	15,260	61,520	32,484	125,687
Solvent Still Bottoms, N.O.S.	1,301	4,751	2,243	7,325	3,544	12,076
Filtration Residues from Dry Cleaning Operations	790	2,354	2,342	6,979	3,132	9,333
Cyanide Wastes	0	0	0	0	0	0
Strongly Acidic or Alkaline Wastes	2,030	7,557	683	2,513	2,713	10,070
Spent Plating Wastes	0	0	0	0	0	0
Waste Ammonia	550	774	12	50	562	824
Photographic Wastes	3,696	12,321	1,251	5,101	4,947	17,422
Ignitable Wastes	213	948	55	150	268	1,098
Wastewater Treat Sludge Contain Pentachlorophenol, Creosote			396	1,167	396	1,167
Waste Formaldehyde	4,000	20,820	415	1,748	4,415	22,568
Waste Oils, Greases or Lubricants	81,020	347,946	414,157	1,871,296	495,177	2,219,242
TOTALS	125,438	516,419	443,603	1,981,455	569,041	2,497,874

1 Excluding c,w, and z waste (i.e., empty containers and lead acid batteries)

Figure 2-2
Extrapolated Waste Quantities by Generator Category (SQGs andVSQGs only) (Gallons/Yr.)



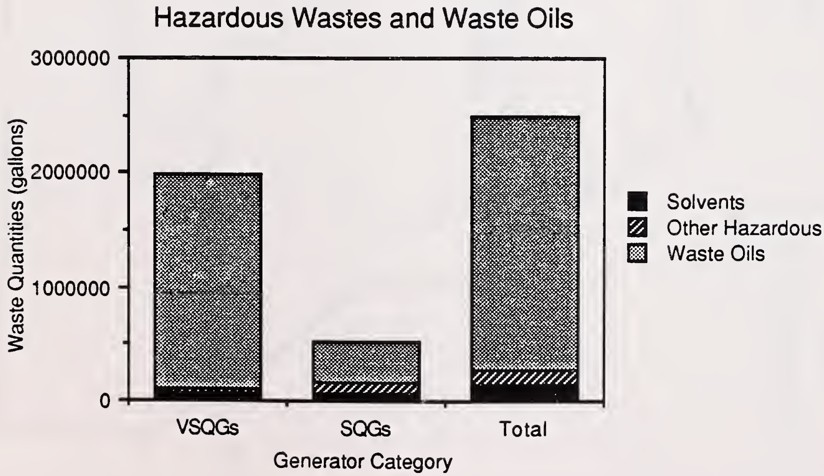


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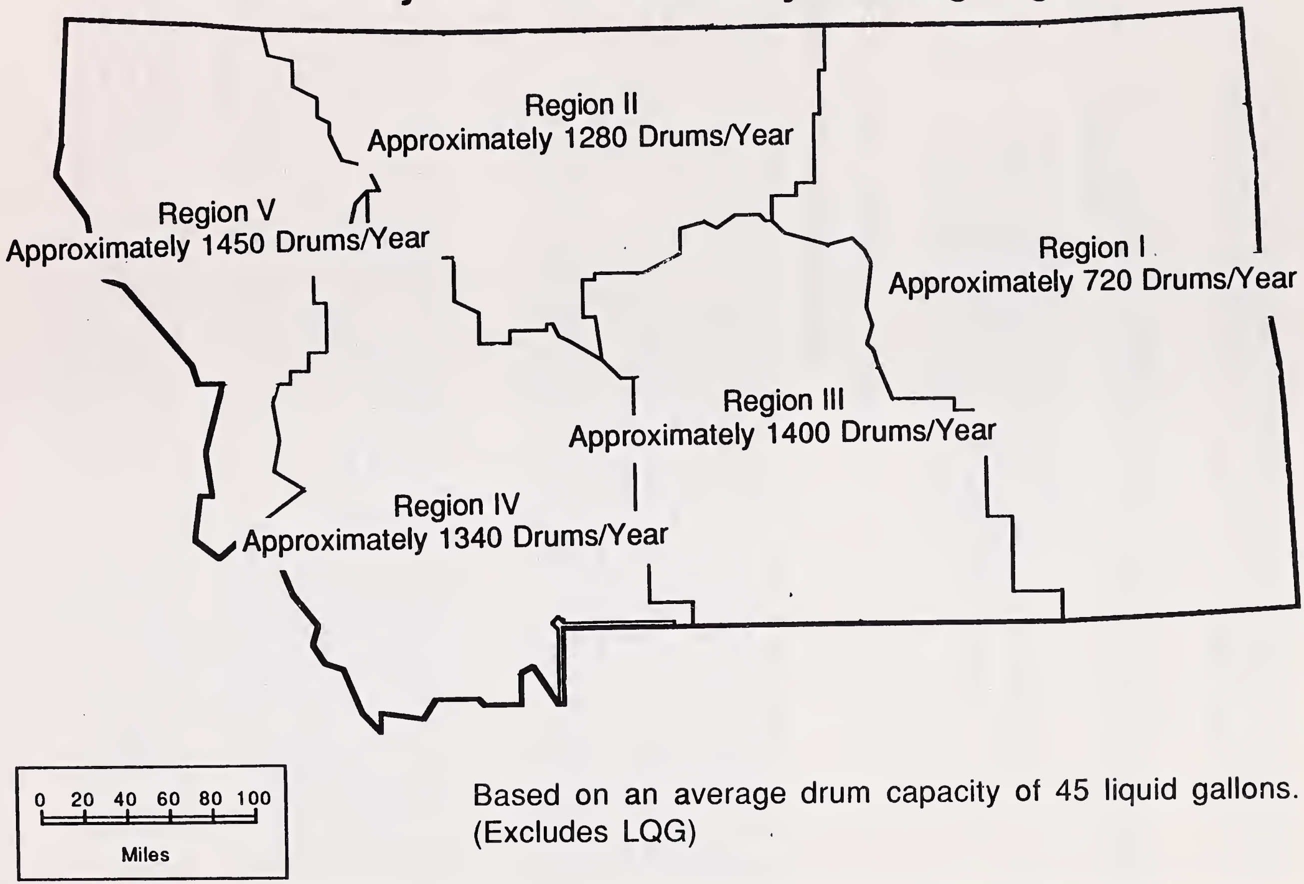
Figure 2-3
Extrapolated Estimates of Hazardous Waste Generation by SQGs and VSQGs by Planning Region



Based on an average drum capacity of 45 liquid gallons.
(Excludes LQG)

have the potential to change current waste generation and/or management practices. An analysis of these potential effects is necessary if any prediction of future waste generation is to be accurate.

While the 1984 amendments covered a wide range of topics, five of these have the greatest potential to affect further waste generation in Montana:

1. land disposal restrictions
2. small quantity generator (SQG) requirements
3. waste minimization requirements
4. listings/delistings of hazardous wastes
5. redefinition of solid waste

Each is discussed separately below.

Land Disposal Restrictions

The Congressional intent of the 1984 RCRA amendments was to minimize land disposal of hazardous wastes. The land disposal of bulk or non-containerized liquid hazardous wastes and non-hazardous liquid is now prohibited. On 28 May 1986, EPA published a schedule setting forth the order in which listed hazardous wastes will be prohibited from land disposal unless EPA can set appropriate treatment standards or grant case-by-case exemptions. EPA met one of its scheduled deadlines on 7 November 1986 when the agency promulgated specific treatment standards and effective dates for hazardous wastes included in the first phase of the land disposal prohibitions: dioxin and solvent containing hazardous wastes.

As a result of the current and scheduled land disposal restrictions and the minimum technological requirements for new or expanding land disposal facilities, the costs of land disposal will increase. More and more hazardous waste will require treatment before land disposal. The removal of land disposal as a management alternative may serve to encourage generators to minimize this waste or treat it on site, therefore reducing the quantity of waste shipped off site. The outcome cannot be predicted at this time and will not be apparent until sufficient time has passed for generators to adjust their practices.

Land treatment or "land farming" of hazardous wastes is regulated as land disposal, and therefore hazardous wastes disposed of in this manner will become subject to treatment standards and restriction. This could affect the current land farming of hazardous petroleum refinery wastes in Montana in the future.

However, the agency is evaluating the possibility of classifying land farming as a best demonstrated available treatment (BDAT) technology as opposed to land disposal.

Small Quantity Generator (SQG) Requirements

The 1984 RCRA amendments include requirements for small generators of hazardous waste in quantities between 100-1000 kg/mo. EPA finalized additional regulations for these generators in March 1986 which effectively require them to meet most of the large generator requirements. It is estimated that there are 465[2] 100-1000 kg/mo generators in Montana who must now manage their waste at hazardous waste facilities which are permitted by EPA, licensed by an authorized state, or have interim status. Their potential for major impact on future waste generation was the impetus for the focused survey of their waste generation and management practices undertaken in this study; their impact at this time is therefore estimated and is not expected to change dramatically in the near future.

Waste Minimization Certification

As of 1 September 1985, generators of hazardous waste have been required to sign a waste minimization certification on each manifest form and to document their waste reduction efforts on biennial (annual) reports. Based on the 1985 annual reports from Montana generators, most are implementing some form of source reduction program ranging from process changes to waste segregation. One generator reported 60% reduction in hazardous waste generation from 1981 to 1985.

100-1000 kg/mo generators must sign a different version of the waste minimization certification on the manifest form accompanying each off-site shipment of hazardous wastes. The overall results of the waste minimization certification requirement on Montana waste generation will be difficult to gauge since 100-1000 kg/mo generators have only been required to document their waste reduction efforts since October 1986. It is unlikely that there will be a significant reduction in waste generation in Montana within the near future since most of the generators are within the small generator category and do not have as many choices in terms of process changes or product substitution. In addition, small generators may lack the financial resources to implement waste reduction technologies.

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[2]Estimated from results of the Small Quantity Generator Survey.

Background Information On Waste Minimization

On 1 October 1986, EPA published in the Federal Register a final rule requiring generators of 100-1000 kg/mo to sign a revised version of the waste minimization certification on the manifest form. The large generator certification was also altered to more accurately reflect the statutory language which provides that generators be able to select the most practicable method of treatment, storage, or disposal currently available to them. A new version of the manifest form was produced as a result of these changes.

In the 30 October 1986 report to Congress on waste minimization, EPA concluded that neither mandatory performance standards nor required management practices are needed at this time to encourage waste minimization. This conclusion was based on a study of 22 industrial processes.

EPA says that industry has the potential to reduce one third of wastes generated. The agency plans to develop an additional database of waste reduction techniques and to provide technical assistance to companies. EPA has indicated that no federal regulatory program for waste minimization could be put into place until the 21st century.

Listings/Delistings of Hazardous Waste

The 1984 RCRA amendments identified specific chemicals and process wastes which EPA must evaluate for possible listing as hazardous wastes. EPA must also do the following:

a) identify and list those wastes containing known carcinogens at levels which could endanger human health;
b) identify any other general characteristics that would cause a waste to be classified as hazardous; and
c) redefine the Extraction Procedure (EP) Toxicity test by considering additional hazardous waste characteristics and measures of toxicity.

EPA has already listed chlorinated dioxins, chlorinated dibenzofurans, and four additional spent solvents as hazardous wastes. The agency also redefined the universe of solvents considered listed hazardous wastes, bringing certain spent solvent mixtures under RCRA control.

EPA recently decided not to relist six smelter wastes and used oil destined for recycling as hazardous wastes. They are

conducting studies to determine if used oil being disposed of should be listed as a RCRA hazardous waste or regulated under a different statute.[3]

The delisting requirements which required a generator to prove that the waste did not exhibit the characteristic for which it was listed were revised by EPA so that generators must also prove that the wastes cannot be classified as hazardous under any circumstances. The 1984 RCRA amendments required EPA to make final decisions by November 1986 on any temporary delistings that were granted prior to the enactment to the amendments.

Due to the increase in requirements for delisting petition and the increased number of wastes and factors EPA must now consider for hazardous waste determination, it is probable that there will be an increase in the wastes considered and regulated as hazardous under RCRA.

Redefinition of Solid Waste

On 4 January 1985, EPA expanded the definition of solid waste to include materials which are recycled in specific ways. Since hazardous wastes are a subset of solid wastes, the new definition increases the scope of hazardous wastes regulated under RCRA subtitle C.

In most cases, materials that are solid and hazardous wastes when recycled are subject to the general hazardous waste management regulations (i.e., generators of wastes destined for recycling are subject to 40 CFR Part 262, transporters of wastes to be recycled are subject to 40 CFR Part 263, and recyclers who are not generators of the waste are subject to the 40 CFR Parts 264/65). There are specific recycled materials that are regulated less stringently under 40 CFR Part 266. Generators who recycle their hazardous wastes on site and do not store, transport, treat, or dispose of hazardous wastes (ie., are using a "closed-loop" recycling process) are exempt from all but the generator requirements for these wastes and need not include the amounts in the determination of generator category.

Due to the increase in types of wastes and recycling activities that are now subject to hazardous waste management regulations and the exemption from regulation for certain types of on-site recycling activities, it is expected that there will be a shift from off-site to on-site recycling of hazardous wastes.

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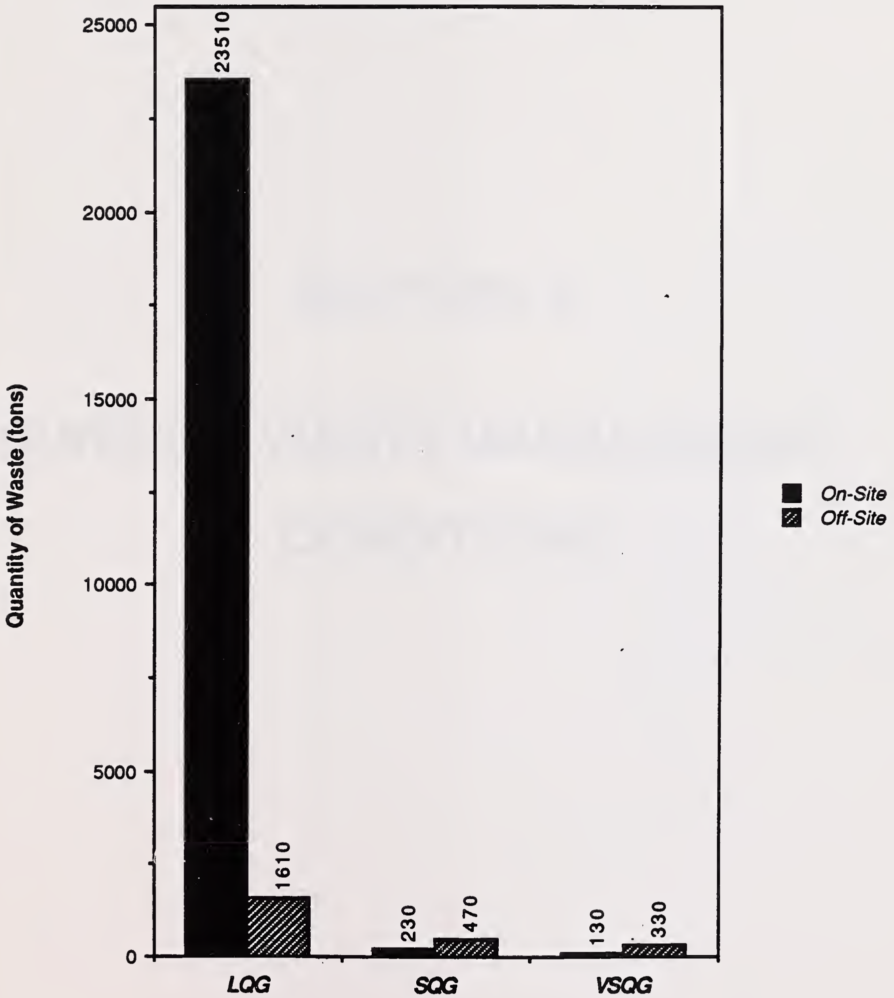
[3]Used Oil and Solvent Study for the State of Montana.

Summary

No changes to future waste generation can be quantitatively expressed at this time; future waste generation is expected to remain at current levels in the short term. Current total quantities of waste generated by LQGs, SQGs, and VSQGs are presented for comparison in Figure 2-4. It should be noted that the LQG waste generation estimate is provided by 1985 regulatorily required Annual Report data, while generation estimates for SQGs and VSQGs is provided by extrapolated survey results. While LQG waste far outweighs SQG and VSQG wastes, a small percentage of it (6%) can be considered available for management by a state-recommended option, i.e., only that waste which is currently sent off site for treatment and/or disposal can be considered as a potential market. However, high potential for mismanagement of SQG and VSQG waste and the current lack of services to this group of generators suggest that their waste is an extremely important potential market sector for any state-initiated management option.

Figure 2-4
Waste Quantities by Generator Category
(All Generators)



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SECTION 3

CURRENT WASTE MANAGEMENT CONDITIONS

SECTION THREE

CURRENT WASTE MANAGEMENT CONDITIONS

Current management methods are an important indication of the priorities and perceptions of generators concerning waste management. They also provide a "snapshot" picture of the current hazardous waste treatment and disposal services.

Information on large quantity generator management methods was obtained from the 1985 Annual Facility Reports. Information on current management practices of small and very small generators was obtained from the small quantity generator survey and was used to produce extrapolated estimates of waste quantities managed by various methods. Telephone and personal interviews with generating operations of all sizes produced additional management information, as well as current associated costs. Information on the current hazardous waste services marketplace was provided by these sources and by a survey of commercial TSD facilities currently being used by Montana generators as well as all available facilities in six western states.

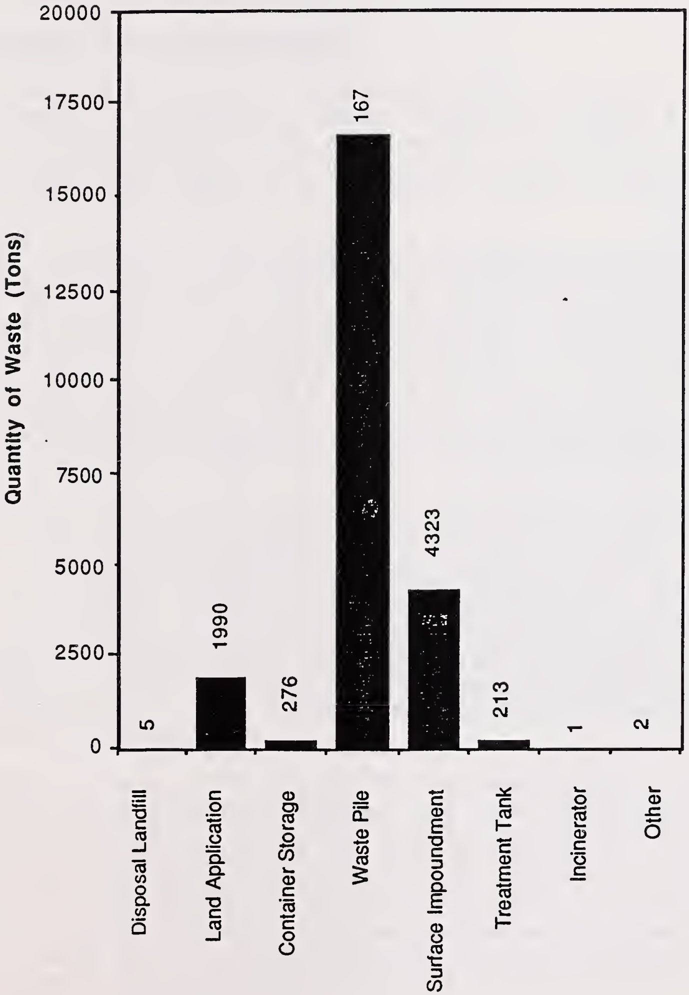
Large Quantity Generator Management Methods

Management data for large quantity generators was obtained from two sources: 1985 Annual Facility Reports and generator interviews. The 1985 Annual Facility Reports represent waste treated on site only, and as such do not fully describe the range of management practices used both on and off site. However, since 94% of the hazardous waste generated in Montana by large quantity generators is treated on site, management data from these on-site reports represents the majority of management practices. A breakdown of handling methods used for these facilities is presented in Figure 3-1. Results of generator interviews are presented in a later subsection.

Extrapolated Estimates of Small Generator's Management of Waste

Extrapolated estimates of hazardous waste quantities managed by various methods as per the survey showed similar management methods used by SQGs and VSQGs. SQGs are estimated to dispose of 67% of their hazardous waste off site, with 30% of this waste going to recycling, 22% being taken to a landfill by a contracted hauler, 20% being disposed of by sewer, and 9% being taken to landfills by the generator. The highest percentage of the waste treated on site (32%) is estimated to be burned for fuel value, while 21% is estimated to be disposed of by sewer. VSQGs are

Figure 3-1
On-Site Handling Methods Used by Large Quantity Generators



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estimated to dispose of 72% of their waste off site, with 33% of this waste slated for landfill disposal by a hauler and 22% slated for recycling. The highest percentage of the waste treated on-site by these generators (28%) is estimated to be burned as fuel. Complete breakdowns of hazardous waste management methods used by SQGs and VSQGs are presented in tabular format in Appendix C; graphical summaries of the major management methods are presented in Figure 3-2.

<u>Existing Waste Handling Services</u>

No licensed commercial hazardous waste disposal facilities currently exist in Montana. Also, there are very few sanitary landfills in the state that will accept hazardous waste of any kind. It is not practical or economical for most generators to transport their own waste to a licensed commercial TSD facility.

There are several firms that are available to contract with generators in Montana to handle and dispose of their hazardous wastes. Most of these firms act as brokers; they will contract with the generator to collect, transport, and dispose of the hazardous wastes at licensed facilities. These brokers most often will make the necessary arrangements to manage the waste even though the firm does not actually own and operate a hazardous waste disposal site. There are also firms that provide hazardous waste management services to Montana that own and operate their own transfer equipment and disposal site.

Five brokers or firms were mentioned during interviews with various generators throughout the State as being actively involved in the management of hazardous wastes. There are undoubtedly several other firms that operate in the state or region (generators should check with the DHES for a full listing of possible brokers or firms that provide this service if the need arises). These firms provide various degrees of service, ranging from providing full collection and disposal to providing only a disposal site with the generator responsible for transporting the waste.

In addition to out-of-state firms, a subsidiary of the Montana Power Company was recently formed for the purpose of providing management services for hazardous waste generators in Montana as well as North Dakota, South Dakota, Wyoming, and Idaho. This firm, Special Resources Management, Inc. (SRM), is in the process of implementing a system of collection vans and storage facilities in the region to manage hazardous and other wastes for small and large quantity generators. At the present time, SRM will contract with various licensed facilities to dispose of their clients' hazardous waste.

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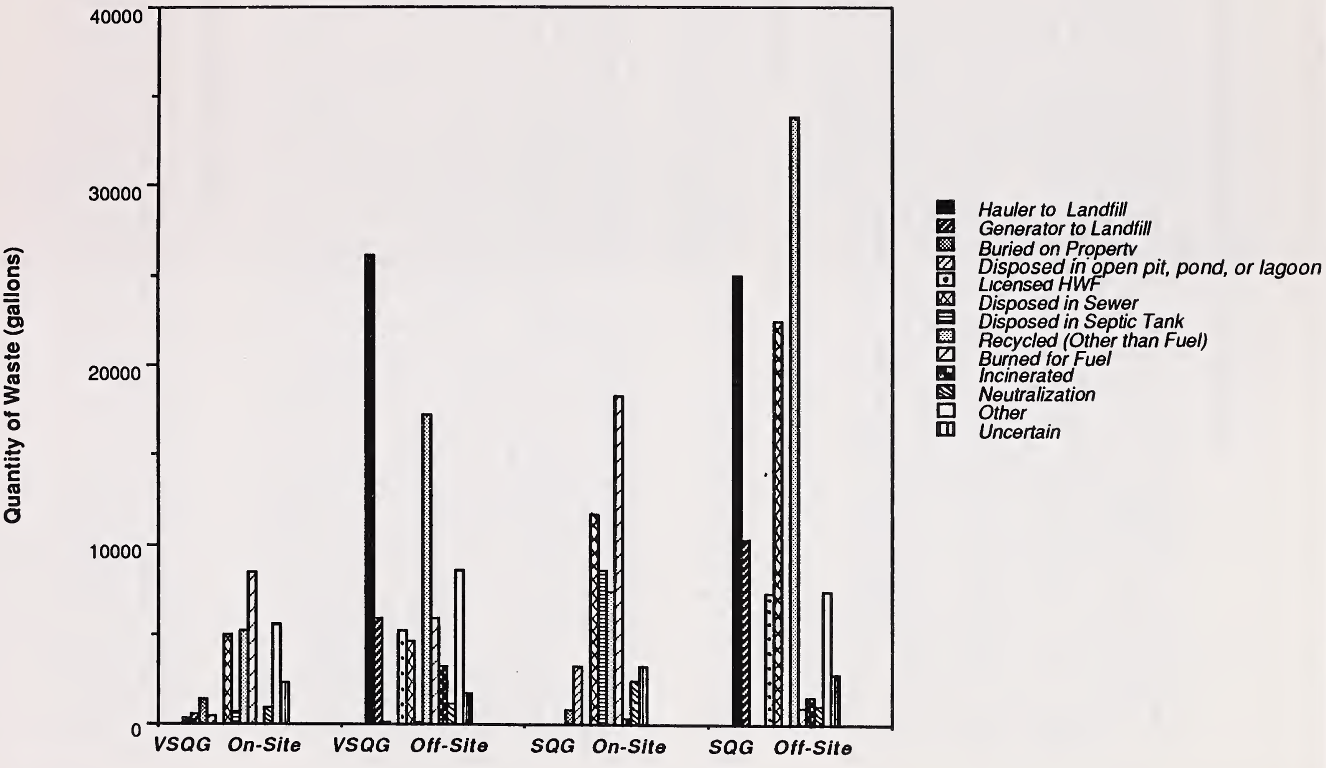
Figure 3-2
Quantity of Hazardous Wastes by Management Method
(VSQGs and SQGs)



Existing Class II Sanitary Landfill Policies

The consultant interviewed individuals responsible for operating several of the Class II Sanitary landfills throughout the state. Of the 16 landfills that were represented by these interviews, 14 of the responsible parties indicated that no hazardous wastes are accepted regardless of the quantities generated. The individuals representing the remaining two sites both indicated that they would also prohibit the disposal of hazardous wastes once an option became available. Through additional interviews with small and very small generators, the consultant discovered that this ban on use of the existing sanitary landfills for disposal of hazardous wastes has forced most generators to store their wastes in containers on their premises. It is quite apparent that many generators and landfill operators are keeping a close eye on the results of this study in hope that a disposal site or program will be implemented.

Generator Interviews

Generator interviews were conducted to provide informal additional information concerning current costs of waste management and disposal practices.

The results of these interviews indicated that approximately 40 companies or governmental agencies in Montana have shipped waste to a TSDF in the last two years. Table 3-1 gives a brief summary of many of these disposal practices and corresponding costs. This information was obtained primarily through the consultant's on-site and telephone interviews. Approximately two thirds of these generators contracted with a licensed TSDF to transport their wastes while the remaining one third transported their own wastes to the TSDF. Further analysis of the data indicated that the total cost for disposal, including the estimated transportation cost, varies from $100 to $800 per drum. It is also interesting to note that in most cases the cost per drum for disposal was in the $150 to $350 range for the large generators, whereas the cost per drum range dramatically increased to approximately $250 to $800 per drum for small generators.

Existing Service Market Place

The existing hazardous waste service marketplace was defined by identifying the specific services offered by commercial TSD facilities currently being used by Montana generators, as well as all commercial facilities available in six western states, including Oregon, Washington, N. Dakota, S. Dakota, Idaho, and

TABLE 3-1

SUMMARY OF HAZARDOUS WASTE MANAGEMENT PRACTICES
FOR SELECTED GENERATORS WHO
SHIP WASTE OFFSITE

Type of Business	Type of Waste	Quantity	Method of Disposal	Cost
Refinery	API Separator	--	Landfarm on site	--
	DAF Float	--	Landfarm on site	--
	Leaded Tank Bottom	7 Drums	Ship offsite	\$200/Drum
	PCB	1 Drum	Ship offsite	\$500/Drum
Fertilizer Manufacturer	24D Bags & Filters	1 Truck load	Ship offsite with own truck	\$190/Ton (Bales)
	Filter Sludge			\$60/Drum plus transportation
Hospital	Chemicals	2 Drums	Ship offsite	\$385/Drum
	Solvents	--	Solidify; to landfill	--
	Chemotherapeutic	--	Incinerate	--
	Pathology	--	Incinerate	--
	Infectious	--	Incinerate	--
Refinery	API Separator	--	Landfarm on site	--
	DAF Float	--	Landfarm on site	--
	Leaded Tank Bottom	20 Drums	Ship offsite	\$300/Drum
Produce Pesticides	Pesticides	Full truck load	Ship offsite	\$130/Drum
Research Laboratory	Misc. Chemicals	7 Barrels	Ship offsite to broker or transport own	\$85-185/Drum (Drop Charge) \$130/Drum (Shipping)

TABLE 3-1
(continued)

Type of Business	Type of Waste	Quantity	Method of Disposal	Cost
Wood Finisher	Paint Wastes	2 Drums	Ship offsite	$800/Drum
	Solvents	--	Ship offsite	$564/Drum
Institution	Zylene	3.5 Ton/yr (Total)	Ship to broker	$250
	Solvents		Ship to broker	$150
	Lab Packs		Ship to broker	$375
Chrome Plating	Chromium Sludge	10 Drums	Ship own offsite with rental truck	$110-135/Drum (Drop Charge) $100/Drum (Shipping)
Fabricator	Paint Sludge Chromium	--	Ship offsite	$100/Drum and up
Laboratory	Hydrochloric Acid	--	Ship offsite	$300-400/Drum (Does not include solidification)

Utah (no commercial facilities were identified in Wyoming). A summary of the services offered by these facilities is presented in Table 3-2.

Table 3-2
Facility Descriptions of TSDFs Currently Accepting Montana LQG Wastes and Other "Western" TSDFs

		Wastes Accepted														On-Site Mgt. Methods						Packaging Requirements			Lab Services		Transportation Services							
State	Facility	Acids	Caustics	Cyanides	Paints / Inks	Solvents	Waste oil	Inorganics	Organics	Pesticides	PCB's	Radioactive Wastes	Wastewaters	Contaminated Soil	Metal Bearing Wastes	Treatment	Incineration	Storage	Landfill	Fuel Blending	Solvent Recovery	Drums	Bulk	Minimum Quantities	Samples/Shipments Only	Waste Analyses	Containerized Liquids	Containerized Solids	Bulk Liquids	Bulk Solids	Partial Loads	Full Loads	Milkruns	Comments
Idaho	Envirosafe IDD073114854	•	•		•	•	•	•	•		•			•					•			•	•		•						•	•		Can flush and drain PCB transformers. Lab packs from specific customers only. Each drum physically "stated". Transportation contracted out.
Kentucky	L.W.D., Inc. KYD088438817						•			•			•	•	•	•		•				•	•		•		•	•	•	•	•	•		Nearly at capacity, expect increased capacity in Aug 87; Generator provides waste analysis
Michigan	Chem-Met Services MID096963194	•	•	•	•	•	•	•	•		•		•	•	•	•						•	•		•		•	•	•	•	•	•		Solidification, neutralization w/ lime dust
	Michigan Disposal MID000724831	•			•			•	•	•				•	•	•						•	•		•									All lab work subcontracted out. Also accepts BOF and electric arc furnace dust. Transports dust waste only.
	Wayne Disposal MID048090833	•	•	•				•	•				•	•	•				•						•			•		•				Lab work subcontracted out. Wastewaters solidified at Michigan Disposal before landfilling.
New York	Frontier Chemical Waste NYD043815703	•	•	•	•	•	•	•	•		•		•	•	•	•		•		•		•	•		•		•	•	•	•	•	•		Cyanide destruction, decontamination of PCB transformers also.
North Carolina	Seaboard Chemical NCD071574164				•	•	•					•	•		•	•		•		•	•	•	•	•	•		•		•		•	•		Small wastewater treatment plant, solidified wastes go to GSX landfill. Minimum quantities = 55 gal drum
North Dakota	Pioneer Fuels						•									•							•		•				•					Filters waste oil, removes chemicals, water for fuel blending.
	Econ Oil NDT390010080						•									•							•		•				•					Filters oil, then sells to burners such as asphalt plants. Looking for spec oil. Off-spec oil tested by generators.
Oregon	Chem Security Systems ORD089452353	•	•	•	•		•	•	•	•	•			•	•				•				•	•	•		•	•	•	•	•	•		No minimum quantity but minimum charge of $200. Use SCA Incinerator. Transfer station in Phoenix, AZ.
	Van Waters & Rogers ORD009227398					•												•					•											Chem distributor transports/stores "reclaimable wastes" at trans fac. for pick-up by Hydrite Chem in WI. Service to be discontinued.
	Baron Blakeslee, Inc. ORD061483384					•															•	•			•		•							Chem distributor. Still-bottoms sent to Calif. for incineration. Minimum quantity = full 55 gallon drum.
South Dakota	B & G Oil						•													•			•		•			•		•	•	•	•	Transports and "cleans-up" lubricating oils
Utah	U.S. Pollution Control UTD980835890	•	•	•	•	•	•	•	•	•	•	•		•	•	•		•	•	•		•	•		•		•	•	•	•	•	•	•	Land treatment of organic refinery wastes. Capacity expansion due end of 1986. Minimum disp fee = $250. Can set up milkruns in some areas.
	Ekotek, Inc UTD093119196					•	•						•			•		•					•		•				•					Solvent recovery to be added in1987
Washington	Chemical Processors WAD000812909	•	•	•		•	•	•	•	•	•		•	•	•	•		•		•		•	•		•		•	•	•	•				Wastes for landfilling and incineration sent to Chem Security. Waste profile is generators responsibility.
	Crosby & Overton WAD991281787	•	•		•	•	•	•	•	•			•	•	•	•		•				•	•		•		•	•	•	•	•	•	•	Primarily wastewater treatment, solidifcation. No minimum quantities but min. charge $200. Milkruns provided for GE.
	Fuel Processors WAD911278200					•	•									•						•	•		•		•		•					Subsidiary of Oil Re-Refining. Off-spec oil ok if only due to flash. Sampling usually. done by oil collector. Considering petroleum waste sludges for future.
	Lilybled Petroleum WAD 027543032					•	•		•						•			•		•	•	•	•		•		•	•	•	•	•	•		At capacity. Fuel blending available soon at new site in Tacoma, WA. Can railcar waste to Systex for incineration.
	McClary Columbia Corp. WAD092300250	•	•		•	•	•									•		•		•	•	•	•		•		•	•	•	•	•	•	•	Division of Chem Process. F Wastes solidified and sent to Rollins landfill in AL. Solvents not reclaimed for a generator are blended for fuel if California incinerator.
	Washington Chemical WAD37991528					•															•	•		•	•		•							Still-bottoms landfilled. Part B approved. 55 gallon minimum. Presently serving western MT.
Wisconsin	Aqua-Tech	•	•	•	•	•	•	•	•	•	•	•		•	•	•			•						•		•	•			•		•	Off-site arrangements for incineration, treatment, & landfill. Explosives accepted. Transportation service; licensed in MT.
Colorado	Mountain Chemical COD040713562																																	No info available; Company filed for bankruptcy

SECTION 4

EVALUATION OF APPLICABLE TECHNOLOGIES

SECTION FOUR

EVALUATION OF APPLICABLE TECHNOLOGIES

Reevaluation of needed facilities in Montana required a reexamination of potentially appropriate waste technologies. Waste management technologies can be divided into five main categories based on processing concept. These categories are as follows:

- recovery technologies (material or energy)
- thermal destruction technologies
- treatment technologies (physical/chemical/biological)
- disposal technologies
- transfer technologies

Brief summary descriptions of the technologies examined can be found in Tables 4-1 through 4-7 at the end of this section.

A number of specific technologies within each category were evaluated for their applicability to Montana-generated waste. Specific technologies within each category were screened for further consideration in this study based on the following:

- suitability of process to waste types generated in Montana
- level of demand present (using estimates produced in this study)
- compatibility of technology with existing services in the state.

The analysis for each technology category follows.

Recovery Technologies

Recovery technologies recover materials or energy from waste as a saleable product. They include:

- recovery of organic constituents (solvents, oils)
- acid regeneration
- metals recovery
- energy recovery (fuel blending)

Recovery of Organic Constituents

Solvent Recovery

Solvent recovery removes contaminants from used solvents. The result may be as pure as the original solvent or of lesser quality. Solvent recovery is a common captive process; commercial solvent recovery facilities typically handle streams which cannot be economically recovered on site or require more specialized equipment. Commercial solvent recovery operations feature storage to accumulate sufficient quantities of particular solvents for efficient separation. Separations are run on batches of like solvents rather than blends of the total feed to the facility; separations are more effective if there are fewer major components of the feed.

Distillation is the most widely used method for solvent recovery, in spite of being capital and energy intensive. It is not suited to streams having high solids or dissolved solids concentrations, which tend to plug the equipment. Other commonly used solvent recovery methods include agitated thin film evaporation, steam or air stripping, physical separation (decanting, settling, filtration), ultrafiltration using synthetic membranes and filtration using ceramic membranes.

Still bottoms are the only by-product of solvent recovery requiring further treatment. They are usually viscous liquids which may be landfilled under certain circumstances or incinerated. Many solvent recoverers blend high-BTU value still bottoms with fuels to make industrial grade fuel oils. Airborne solvent vapors are sometimes generated from storage areas, but these are minimized by using conservation vents on tanks.

Economics of a solvent recovery facility for Montana are examined in detail in the companion report to this study, "Used Oil and Solvent Study for the State of Montana" and will not be repeated here.

Waste Oil

Recyclers of waste oil can be broken down into two main categories: 1) those who recycle the oil for fuel, and 2) those who re-refine it for reuse as lubricants. The two categories differ more in the end use of the products than in the processes used.

Recycling generally involves an emulsion breaking process, centrifugation, a high heat or topping tower process and a final

filter process. Recycled oil can be substituted or supplemented with No. 2, 4, 5, or 6 grade virgin fuel oil and used as a fuel source.

Waste oil re-refining generally employs either the outdated acid/clay method or modern vacuum distillation. New technologies such as thin-film evaporation and supercritical extraction may eventually become important.

The spent clay from the acid/clay treatment method is a troublesome waste stream, since it is considered hazardous and is voluminous compared to the quantity of waste oil treated. The only apparent disposal option for this stream is secure landfill. The distillation of waste oil produces a single waste stream and still bottoms, which can be sold as a feed stream for a fuel blending operation, but may also be incinerated or landfilled under certain circumstances.

Waste oil re-refining will produce some oils of a quality virtually equal to lubricating oils refined from virgin feedstock. Lower grade oil suitable for fuels is also recovered, often amounting to over fifty percent of the oil processed by a re-refinery.

The relative amounts of waste oil that are recycled versus re-refined has been a controversial topic for years. Until EPA published its final rule on the regulation of waste oils on 29 November 1985, recyclers of waste oil for fuel far outnumbered re-refiners. There has been a sharp reduction in the number of re-refining companies, from over 150 some 30 years ago to only about 12 in North America today. By contrast, there are at least 250 recyclers in the United States alone. A number of factors may serve to shift the situation in the future, including the economies of recycling (the relative prices of used and virgin oils according to the end use), new regulations for waste oil, transportation costs, and future available capacity.

Economics of waste oil recycling are examined in detail in the report, "Used Oil and Solvent Study for the State of Montana," and will not be re-examined here.

Acid Regeneration

Acid recovery refers to the separation of unreacted acid from an acid waste. The more widely practiced acid recovery technologies involve either crystallization or incineration with sulfur dioxide (SO_2) conversion.

Crystallization is used extensively for the recovery of pickle liquor, which is an acid used for the removal of oxide scales in the metal finishing industry and which comprises a major portion of the recoverable acid waste in the U.S. It may be hydrochloric, sulfuric, nitric or a mixture of those acids; recovery, however, is practiced only for hydrochloric and sulfuric acids. The classical recovery process involves the removal of impurities through crystallization, but also may include refrigeration, filtration, and vacuum evaporation. Crystallization is applicable to any hydrochloric or sulfuric acid pickle liquor. The process is usually set up to be repeated continuously with the recovered acid added to the fresh acid feed. The only output stream from the process is the recovered crystals which usually have a resale value as fertilizer or as livestock feed additives.

Currently, the acid recovery process is used only as a captive operation by metal finishers. Most metal finishers still neutralize acid wastes or simply contract for their disposal. As the costs of transportation, utilities, and neutralizing chemicals go up, acid recovery should find wider application. Also, it is likely that a separation technology will develop for recovering other types and mixtures of acids.

The incineration technique used in acid recovery is applied to various sulfuric acid bearing wastes. Acid waste sludge, mixed with elemental sulfur and supplemental fuel (as required), is charged into a furnace at temperatures near 2200°F. At this temperature the sulfuric acid decomposes; it is later recovered as pure sulfuric acid. Combustion gases leave the furnace at 1800°F; and the heat is then recovered by a waste heat boiler to cogenerate electricity.

Incineration can handle a wide variety of acids and acid sludges from such diverse process wastes as refinery and alkalation sludges, sulfonation sludges, acids from chlorine drying, and oil sludges. Several facilities of this type are currently operating in the US, ranging in capacity from 600 to 1100 tons/day of regenerated sulfuric acid product.

An acid recovery plant handling 2.5 million gallons per year of sulfuric acid pickling liquor with zero discharge would require a capital investment of $700,000. Annual operating costs, including credits for acid and ferrous sulfate crystals, would be about $150,000.

Metals Recovery

A number of wastes are considered hazardous because they contain one or more of the following metals:

Arsenic	Lead
Barium	Mercury
Cadmium	Selenium
Chromium	Silver

These wastes may be recovered by many of the processes developed and practiced by the primary and secondary metals industry. These processes include neutralization/precipitation, evaporation, electrolysis, ion exchange, reverse osmosis. hydrometallurgy, pyrometallurgy, and others. Each process is suitable to the recovery of a specific metal in a specific situation. Process descriptions for the most common techniques can be found in the Chemical/Physical/Bilogical treatment section.

Most metals recovery today is practiced for precious metals, (e.g., silver), on a source-specific basis (e.g., "closed loop" nickel recovery), or in certain cases where the metal is in large quantities in a readily recoverable form. An example of the last is pyrometallurgy, used by a Pennsylvania primary metals plant to process electric arc furnace dusts in its Waelz kilns. This produces an impure zinc oxide, containing some lead, which is sold to another metals company for recovery by electrolytic methods.

A key problem is that hazardous wastes are not particularly rich in a recoverable metals and contain contaminants other than those intended for recovery.

A centralized metal recovery facility would combine electroplating, metal finishing, and filtration processes. A study of such a facility for the Minneapolis-St. Paul metropolitan region estimated the facility would cost $7 million to construct and $1.5 million per year to operate.

Fuel Blending

Fuel blending operations accept all types of high to medium heating value organic wastes, treat and mix them to meet current fuel standards, and sell the product to industrial users for heat and steam production. Processes employed include flocculation, settling, filtration, heating, acid-emulsion breaking, screening, chemical addition, and mixing. The number and complexity of processes varies widely from one facility to another. Fuel

blending is now very common, due to fluctuations in fuel prices over the past ten years and the increase in disposal costs, especially for organic liquids.

Acceptable waste streams include oils, organic sludges and still bottoms, solvents, other organic solutions, greases, and miscellaneous residuals from other treatment methods. Heating value and certain toxic constituents are the main limitations. Halogenated solvents are usually not blended because of their lower heating value, chloride content, and toxic characteristics. The only residual produced is the solids and impurities removed from the waste fuel, usually as an oily sludge which is typically landfilled.

A fuel blending facility capable of handling 6 million gallons of waste per year (a relatively high volume) would have an estimated capital cost of approximately $3.5 million. Annual operating costs would be approximately $1.3 million. Costs could be recovered through sale of recovered product.

Summary

Low demand for acid regeneration and metals recovery services do not warrant further consideration of these technologies. Recovery of organic constituents and recovery of energy by incineration of such organics in existing cement kilns, power plants, etc., was investigated in detail as part of this project. This analysis is reported in a separate document entitled "Used Oil and Solvent Study for State of Montana", dated July 1987.

Thermal Destruction Technologies

Thermal destruction technologies destroy a very broad range of organic wastes by exposing them to high temperatures in the presence of air, thereby effecting either partial or complete oxidation. Commercially available or well-developed technologies include the following:

- liquid injection incineration
- rotary kiln incineration
- fluidized bed
- multiple hearth
- wet air oxidation.

The first two technologies are widely used commercially; the latter three are used mostly for non-hazardous waste at on-site facilities and as such will not be reviewed in detail here.

Liquid Injection Incineration

The liquid injection system is the most frequently used hazardous waste incineration system in the U.S. It has a very simple design with virtually no moving parts and is capable of incinerating a wide range of liquids, gases, and slurries. The combustion process is the same for both land-based and ocean incineration systems, and the two differ only in the pollution control technology and energy recovery equipment used.

Liquid waste is atomized by a burner or nozzle and is injected into the combustion chamber. This atomization divides the liquid into many small droplets, maximizing the surface area of the liquid where the oxidation reaction occurs and thus increasing reaction efficiency. For this reason, liquid injection incinerators are quite compact compared to other forms of incineration equipment. The combustion chamber is commonly a cylinder lined with refractory material and may be fired horizontally, vertically upward, or vertically downward, according to the needs of the owner. All existing ocean incinerators employ vertically mounted cylinders. A forced draft system supplies air to the combustion chamber for combustion as well as turbulence for mixing.

Land-based incinerators include air pollution control devices for acid gases and particulates and systems for treating or disposing of scrubber water and ash residues. Land-based incinerators also commonly recover energy, often in the form of steam. It has been estimated that about one-fourth of incinerators burning liquid hazardous waste employ heat recovery, although HCL resulting from the combustion of chlorinated wastes limits the use of heat recovery equipment due to its corrosivity. In general, the median capacity for land-based incinerators is about 150 gallons/hour. In a recent EPA survey, only 8 land-based incinerators reported a capacity greater than 2000 gallons/hour. Because of the small size of most liquid injection incinerators, little auxiliary fuel is required to achieve the operating temperatures of 1800° to 3000°F. Continuous operation of the incinerator is also preferable, since the refractory lining is sensitive to large temperature fluctuations.

Feed streams for liquid incineration must be pumpable liquids. Other important waste characteristics include very low solids content, low water, ash, and halogen content, and preferably high heating value. Wastes are often filtered and mixed to form a homogenous feed. Most liquid incinerators in use were designed

for one specific waste stream, but incinerators that can be used for treatment of a wide range of waste feeds are currently being designed.

Air emission standards require the removal of particulate and noxious gas from the combustion gas stream of land-based incinerators. The U.S EPA requires 99.99% destruction/removal efficiency of principal organic hazardous constituents. Incinerating hazardous liquids typically produces a small amount of ash that is usually disposed of in a landfill.

Capital costs for a 10,000 ton per year liquid incinerator are about $7 million. Smaller incinerators can be constructed at lower costs. The maintenance costs for a liquid incinerator are relatively low because of the simple design. Operating costs include periodic rebricking, fuel costs, chemicals for air pollution control equipment, and maintenance of air pollution control and waste feed systems. Commercial incineration facilities typically charge around $0.30 to $1.05 per gallon ($100-$300 per ton). These charges vary with the character of the wastes.

<u>Rotary Kiln Incineration</u>

A rotary kiln incinerator employs the same refractory lined cylinder as a liquid injection incinerator, but differs in that the cylinder is positioned slightly inclined from horizontal and rotates about its axis. A tumbling action, which conveys the waste through the kiln as it burns, results. The tumbling action also allows better mixing of the waste with hot gases, creating more complete combustion, and aids in the breaking up of solid wastes to a fine completely burned ash. Rotary kiln systems are capable of incinerating solid, sludge, liquid, and gaseous hazardous wastes either separately or simultaneously. Solid wastes are usually combusted with fuel or high-BTU liquid wastes to maintain high temperatures as a combustion aid for low heat content solids. The versatility of rotary kilns has led to widespread use in large commercial facilities in the U.S. and regional hazardous waste management facilities in Europe.

Solid wastes enter at the high end of the kiln, and liquid or gaseous wastes enter through atomizing nozzles. An auxiliary and/or waste fueled flame heats the kiln to operating temperatures. The rotation of the kiln causes the ash to move to the lower end of the kiln where it can be removed along with the combustion gases. Secondary combustion chambers or afterburners may also be present to ensure complete combustion of the wastes. It is preferable to operate a rotary kiln on a continuous basis

because so much auxiliary fuel is required to heat the kiln to the operating temperatures of 1500° to 3000°F.

The main limitation on waste feeds to a rotary kiln is that such feeds must be organic, with little water present. The kiln can easily accept solids, sludges, liquids, or gaseous wastes. Rotary kiln technology has great potential for treatment of solid and drummed wastes, as well as wastes which contain a liquids and solids mixture.

Capital costs for a rotary kiln incineration facility range from about $20 million for a 10,000 tons per year unit to nearly $55 million for a 50,000 tons per year unit. Operating costs for a rotary kiln facility are more than other commonly employed methods of incineration, since the kiln requires frequent regular maintenance. Rotary kiln incineration facilities typically charge around $300-$500 per ton on non-liquid waste.

Summary

The economics of incineration is dependent upon sufficient quantities of incinerable waste as well as a demand for steam if energy is to be recovered; the incineration process itself requires a constant stream of waste feed to avoid costly restarts. The economics of incineration also improves greatly with economies of scale. The amount of waste potentially available in Montana for any type of commercial facility (2400 tons of currently off-site waste produced by LQGs, SQGs, and VSQGs; the percentage of this which can be considered incinerable waste is unknown) is far below the range in which incineration is normally considered (>10,000 tons per year). In addition, several marketing studies undertaken for the purpose of defining the future nationwide need for incineratin capacity have indicated that current liquid incineration capacity is not being fully utilized. Existing cement kilns and industrial boilers offer yet another alternative for treatment of incinerable waste. In conclusion, the waste quantities present in Montana are not sufficient to economically support an incineration facility; other alternatives, such as cement kilns, exist in Montana and may serve to lower even further the potential demand for such a facility.

Treatment Technologies

Various chemical, physical (other than thermal destruction), and biological processes can be used alone or in series to process hazardous wastes. Processes may detoxify or destroy waste constituents, separate the hazardous and non-hazardous components of a waste stream, or reduce the degree of hazard by altering the

physical or chemical matrix in which the hazardous constituents are contained. The technologies can be grouped as follows:

- conventional aqueous treatment
- separation
- other physical/chemical treatment technologies
- biological treatment
- solidification, stabilization, and fixation

Conventional Aqueous Treatment

An aqueous waste treatment system removes and/or detoxifies hazardous constituents which are dissolved or suspended in wastewater. The conventional processes are oxidation/reduction, neutralization/precipitation, and solids/liquids separation.

Chemical oxidation/reduction refers to chemical transformations which are achieved through chemical addition to a feed stream other than mere alternation of pH or precipitation of components. It has gained acceptance in industry for reducing complexed metals and is most effective when the aqueous metal wastes are relatively free of organic compounds. Chromium wastes are perhaps the most common wastes treated in this way. Chemical reduction is very efficient, achieving greater than 90 percent reduction in 1-2 hours of continuous process time. Residual chemicals in the product stream may require subsequent treatment such as removal of sulfides and/or sulfites.

Chemical reduction treatment of chromium is limited to aqueous streams due to the ease of surface contact between the reducing agent and the constituent of concern. As such, treatment of sludges is difficult. Reduction efficiency can also be significantly lowered by the presence of organic compounds and complexes, interfering with the process and adding potential for hydrogen sulfide emission. A large amount of metal hydroxide sludge can also be generated.

Precipitation and neutralization are chemical transformations, often carried out together. Precipitation transforms some or all of a substance in solution into a sparingly soluble compound. In neutralization, the pH of a solution is adjusted to values between 6.0 and 9.0. Neutralization and precipitation are useful for treating aqueous corrosive waste or aqueous streams containing heavy metals; they produce precipitated salts of the original acids or bases and a neutral aqueous solution.

Suitable waste feed streams for treatment by precipitation are aqueous wastes with toxic heavy metals, including arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc.

Precipitation is the most preferred treatment process to remove toxic heavy metals from electroplating wastewaters and is used by approximately 75% of the electroplating facilities treating aqueous metal bearing wastes. It is a common and well-documented treatment method. Neutralization can be carried out on aqueous or nonaqueous corrosive liquids, slurries, and sludges.

The supernatant of precipitation treatment may require further treatment before discharge, although it usually can meet the inorganic limitations typically set for discharge to large municipal sewage treatment plants. Heavy metal sludges will need to be further dewatered and possibly stabilized prior to land disposal as a hazardous waste. The potential for toxic gas evolution must be addressed if the precipitation involves sulfides or cyanides. pH monitoring and control during neutralization is very often required prior to discharging the aqueous stream.

Capital costs to carry out chemical oxidation/reduction may range from $100,000 to $500,000 for systems with a capacity of 1,000 gallons per day. Operating costs depend on the character of the wastes.

Capital and operating costs to carry out neutralization-precipitation vary widely depending on the size of the waste stream being treated. Commercial facilities typically charge from $0.10 to $0.25 per gallon of aqueous waste. However, costs in excess of $1.00 per gallon are possible for some wastes.

Separation Technologies

Carbon adsorption is a treatment process for separation of components, specifically the removal of organics from aqueous solution by activated carbon which has high adsorptive surface areas. The activated carbon may be used either in granular form in columns or powdered and mixed with aqueous feed stream in a suitable reactor. Subsequent regeneration of spent carbon is carried out by thermal action (steam, thermal destruction, etc.) or by chemical action (acid, base or solvent). The carbon can also be discarded with the final process sludge.

Adsorption of hazardous organic and some inorganic compounds onto granular activated carbon can be an effective means of removing low concentrations of hazardous wastes from aqueous streams that are not solvent-contaminated. Adsorption may also be used for recovery of certain organic compounds. In order to be effective, the variety of activated carbon needs to be matched to the compound to be removed. Regenerating the carbon is expensive.

If it is disposed of without being regenerated, it may be treated as a hazardous waste due to the adsorbed compounds it contains.

Adsorption onto synthetic resin is a means of selectively removing or recovering certain organic and some inorganic compounds from an aqueous stream. The resins can be more closely matched to adsorb certain compounds than can activated carbon. The cost of the resin is high, and it is generally not economical to treat large volumes of concentrated wastes in this manner. It is most often used at manufacturing facilities as a pre-treatment operation rather than at commercial TSD facilities.

Capital and operating costs for carbon adsorption vary widely with the nature and concentration of organics in the feed stream.

Emulsion breaking refers to a range of different processes, often employed in combination, for separation of emulsions into two distinct phases. These different processes include the use of American Petroleum Institute (API) and other gravity separators, centrifugal separators, gas flotation devices, granular or fibrous media for coalescence and filtration of the dispersed materials, chemical addition, electrophoretic equipment, magnetic separators, heaters, etc. An emulsion may either consist of two liquids with one liquid fully dispersed in the other or involve the colloidal dispersion of fine solids in a liquid. Different methods are used for emulsion breaking, depending upon the reasons for which the particular emulsion is stable.

One of the most common applications of emulsion breaking is separation of oil and water in refinery waste. A chemical process, such as an acid-alum-lime system, will generate a solid waste which needs to be disposed of. Oil may be recovered, however, in gravity separations, electrophoretic or magnetic systems, or thermal separations. A number of refineries are presently using centrifugal separators, filter media, or chemical additives for emulsion breaking. Electrophoresis is widely used in laboratories and for water purification. Although emulsion breaking is usually performed on site by the generator of the waste, a few commercial facilities offer their service as part of their liquid treatment and disposal operations. Capital costs for a corregated plate separator (100,000 GPD, 3000 ppm oil) may be $10,000 or more. Commercial charges for emulsion breaking are minimal in comparison with other charges.

Ion exchange is a process that separates components, including heavy metal cations and anions, non-metal anions, and organics, from aqueous solutions by exposure to solid or liquid ion-exchangers. The ions are then removed from the ion-exchanger

by exposing it to a second aqueous solution of different composition, thereby regenerating it for reuse.

Ion exchange can be designed to remove any dissolved salts from aqueous solutions (feed streams should be free of suspended matter, surfactants, and oxidants). The product streams consist of purified water and a much lower volume of a concentrated solution of hazardous components. Although ion exchange is a technically feasible method for recovering metal ions from a range of plating wastes for reuse, it is not currently used commercially. Capital costs depend upon the application, with a substantial investment required in ion exchangers.

Membrane separation refers to several different processes involving the transfer of specific waste components from one liquid phase to another through a membrane. These different processes include dialysis, electrodialysis, reverse osmosis, and ultrafiltration. The primary objective of such systems is usually the removal, dilution, concentration, or recovery of dissolved components.

Dialysis is limited to aqueous streams with high concentration of low molecular weight dissolved solids. Electrodialysis, reverse osmosis, and ultrafiltration can be also considered for organic liquids.

The two product streams from membrane separations will typically consist of a purified solution and a concentrated solution of hazardous components. The dilute product stream is usually suitable for discharge after nominal water treatment. The concentrated solution can be recycled, subjected to electrolysis for recovery, or further treated by precipitation.

Though membrane separations are well developed processes, they are rarely used in commercial waste treatment. Electroplating shops have utilized reverse osmosis and ultrafiltration to remove heavy metals from drag-out/rinse waters for some time. Capital and operating costs vary considerably and are typically quite high.

Other Chemical/Phsyical Treatment Technologies

Chemical dehalogenation utilizes a reaction between metallic sodium and polychlorinated biphenyls (PCBs) in a closed system. The patented technique involves a "stripping" of chlorine atoms from PCBs in the presence of metallic sodium. The process is portable and produces a PCB-free mineral oil which can, in some cases, be re-introduced into the transformer from which it was taken. The emissions from the chemical dechlorination process

are essentially salts which are not toxic under the provisions of the Toxic Substance Control Act (TSCA) and the Resource Conservation and Recovery Act (RCRA).

Three companies have developed or are developing processes to treat PCB contaminated mineral oils by chemical dehalogenation. One firm has been permitted by the EPA for PCB destruction and is currently operating.

Biological Treatment

Biological oxidation refers to a range of processes for aqueous streams in which the destruction of organics takes place in the presence of microorganisms. These processes include activated sludge, trickling filter, aerated lagoons, rotating biological contractors, anaerobic degradation, etc. The oxidation or organics may take place either in the presence of air (aerobic) or in the absence of oxygen (anaerobic).

Conventional or extended aeration activated sludge wastewater treatment can be used to treat dilute aqueous organic wastes with flow volumes between 5000 and 30,000,000 gallons per day. Sequencing batch reactor (SBR) technology is becoming more widely used for captive operations that generate waste streams of consistent composition and daily flows under 50,000 gallons per day. In this process, a culture of microorganisms is first acclimated to the waste and then used to treat it. The treated waste is decanted for disposal or further treatment, and the microorganisms are retained in the reactor until the next batch of similar waste is ready to be treated.

Biodegradation can be an effective means of treating some relatively low-strength streams of organic waste. Halogenated and heavy-metal wastes are not generally amenable to biological treatment.

The appropriateness of biologically treating a waste depends on the character of the wastes. The cost and operation of a treatment facility depends upon its size. A treatment facility that can accomodate a capacity of 40 to 100 gpm (a facility with a capacity of 100 gpm is similar in flow to a sewage treatment plant capable of serving 400 homes) would cost approximately $97,000 to construct. It would cost approximately $37,000/yr for operation and maintenance of that facility.

Landfarming is another form of biological treatment, and is currently practiced in Montana on a large scale for the treatment of refinery waste. Land farming means the direct application of wastes to the land at controlled rates, utilizing the natural,

physical, chemical, and biological systems present in the soil to degrade the waste. Biological mechanisms typically play the predominant role. However, wastes are also degraded by a variety of physical and chemical treatment mechanisms. The most suitable types of wastes are oily wastes and organic bearing aqueous wastes. As was discussed previously, land farming of hazardous waste is regulated as land disposal and therefore hazardous wastes disposed of in this manner will become subject to treatment standards and restriction.

Land treatment facilities can produce the following negative impacts on the environment:

1) volatilization or organics from sludges spread on the land surface (air emissions);

2) contamination of run-off due to its contact with newly spread wastes, or wastes which have not yet been completely treated by the soil microorganisms; and

3) waste treatment residuals in the form of metals adsorbed on soil particles and refractory organics which do not biodegrade.

There are a number of land treatment operations currently in practice for the treatment and disposal of hazardous wastes, including those mentioned previously that are currently operating in Montana. However, there is a little reliable long term operational and monitoring data for the proper evaluation of the effectiveness of these facilities. Prices for commercial land treatment vary according to waste type and hazardous constituent concentration, as well as the soil type and the capacity of the treatment facility. A range of prices for commercial land treatment is $5 to $22 per ton. It should be noted that this method of treatment is available only for a limited number of waste types. The waste streams that are most typically land treated include oily sludges, gum and wood products, and some organics.

Solidification, Stabilization, and Fixation

Stabilization/solidification (S/S) processes involve the admixing of materials with wastes to chemically and/or physically immobilize them. Stabilization reduces the solubility and/or chemical reactivity of a waste, while solidification converts the waste into a fixed, solid form with reduced leaching potential. The S/S processes are generally used to treat concentrated waste solids, sludges, slurries, and liquid wastewaters.

S/S processes commonly use either organic or inorganic additives. Organic additives used include chemical grouts, thermosplastic agents, organic polymers, and glassification agents. They are relatively expensive with limited applications. Inorganic processes, using cement, lime, and polyolanic materials, are less expensive with wide application. They are limited, however, by the organic content of the waste.

S/S technologies are widely used both on site and at commercial facilities. As a pretreatment process for landfilling, S/S is expected to increase dramatically by 1990, increasing from its non-measurable 1983 level to an expected 66.1-70.7 million metric tons. S/S processes are generally applied to wastewater sludges which cannot be treated further and require disposal.

The capital costs for a commercial facility stabilizing 100 tons per day may range from $1 to $3 million. The operating costs may range from $20 to $50 per ton of stabilized wastes with mixing in drums considerably higher.

Summary

The O&M costs of most treatment technologies define a minimum size for an economically feasible central facility; this minimum size usually falls in the 10,000 gallon per day range. The quantity of waste available in Montana (the percentage of the approximately 2 million gallons of waste sent off site by LQGs, SQGs, and VSQGs that is applicable for any of the treatment technologies discussed is unknown) does not satisfy this requirement. In addition, the source of most of the waste expected to come to such a facility is SQGs. Their waste typically consists of small quantities of diverse waste; a non-homogeneous waste stream of this type would be extremely difficult to treat. It should be noted that many of the treatment technologies discussed are commonly practiced on a captive basis by large generators, i.e., large volumes of homogeneous waste make on-site treatment economical. If such waste streams exist, it is probable that they are already being treated on site, and such an economically attractive waste stream would not become available for a central facility. For these reasons, the treatment technologies discussed are eliminated from further consideration.

Disposal Technologies

Ultimate disposal of hazardous wastes can occur in one of three ways:

- land disposal
- deep well injection
- placement in surface impoundments

Land Disposal

Land disposal, or the placement of hazardous waste in lined earthen cells, has markedly changed in technology and practice over the past five years. The 1984 RCRA amendments will effect massive changes on landfilling procedures: they include prohibition of disposal of free liquids in landfills, prohibitions on land disposal of specified wastes, and minimum technological requirements including double liners, leachate collection systems, and ground water monitoring. Secure land disposal is the least preferred of EPA's list of preferred waste management strategies.

Deep Well Injection

Deep well injection - disposal of liquid wastes down wells into bedrock - is a method whose viability depends on the surrounding geology. It currently accounts for approximately 8% of the wastes received by the sixteen largest commercial firms. The future of this technology is uncertain; EPA must determine if such disposal is adequately protective of human health and the environment by 8 August 1988 and issue regulations prohibiting it if it is not. It is expected to decrease even if not prohibited, however, due to waste reduction by industry.

Prices charged for deep well injection generally vary with the toxicity of the waste, amount of solids in the waste stream, and the degree of pretreatment required prior to injection. A range of prices for deep well injection for oily wastewaters is $17 to $67 per ton. Prices for deep well injection of toxic wastewaters requiring pretreatment ranges from $120 to $288 per ton.

Surface Impoundments

Placement of wastes in surface impoundments has also been greatly affected by the 1984 RCRA amendments. The minimum required technological standards now include double liners, leachate collection systems, and ground water monitoring. The need for retrofitting existing surface impoundments is expected to decrease use of this practice.

Summary

Land disposal of hazardous wastes is the EPA's least favored method of disposal; current as well as future regulations reflect this philosophy. The regulatory future of other disposal techniques is uncertain as well, and more appropriate treatment technologies exist for the wastes of concern. The quantities of waste present in Montana and the absence of recommendation for any in-state treatment facilities that would produce residuals do not indicate that such a facility would be economically feasible. In summary, the low demand plus the unfavorable status and implications of land disposal preclude these technologies from further consideration.

Transfer Technologies

Transfer technologies are those methods by which waste is transferred from a generator to a treatment/disposal facility or to another generator for use. Transfer technologies do not alter any of the physical or chemical characteristics of the generated waste; they only transfer the waste from its point of generation to its point of disposal or reuse. Use by a new generator who then assumes responsibility for the waste is included, therefore, in this definition of "disposal". Transfer technologies primarily include waste exchange and storage/transfer options. A brief description of each is summarized below.

Waste Exchange

A waste exchange is simply an organized barter system for potentially reusable or recyclable waste, set up by government agencies, trade associates or independent businesses. The organization operates by collecting and publishing information about the waste. Wastes are usually listed with a confidential code number under the headings of "items wanted" or "items available." The organization often specifies that any waste stream may be listed as long as there is not an established market for it (such as for scrap steel or paper).

A waste exchange service is currently being offered in Montana through the cooperative effort of several entities including the Montana Chamber of Commerce and the Montana Solid and Hazardous Waste Bureau. The continued efforts and support of this exchange is encouraged and recommended.

Transfer/Storage Options

The basic transfer facility serves as a collection station for small quantities of wastes, combines like wastes destined for similar treatment or disposal, and ships them in larger quantities to their final destination. A transfer facility differs from other types of waste management facilities in that it is not a waste treatment facility, does not reduce the overall quantity of waste, and does not change wastes' chemical or physical properties. Rather, the purpose is to increase the economic efficiency and reliability of transporting wastes from small quantity generators to treatment and disposal facilities. It therefore provides a repository for the collection of small quantities of waste.

Summary

The small quantities of waste generated in Montana, as well as its pattern of generation over a wide geographical area, necessitates consideration of the transfer/storage option. Various transfer/storage options are evaluated in detail in Section 5.

TABLE 4-1
SUMMARY DESCRIPTION OF MATERIALS RECOVERY TECHNOLOGIES

Technology	Basic Concept	Suitable Wastes	Recovery Product	Residue	Commerical Status	Capabilities/ Limitations
Solvent Recovery	Removal of contaminants by distillation to produce solvents for resale filtration, evaporation, stripping, and blending may also be involved.	Organic solvents, both halogenated and non-halogenated	Recovered solvent of salable quality	Still bottoms	Applied commonly on a captive in-house basis; numerous commercial facilities exist.	Energy-intensive; relative volatility and number of different components will dictate recovery ability; recovered solvents usually have high purity.
Waste Oil Recovery-Distillation	Removal of contaminants by various distillation to produce oil for resale.	Waste lubricating oils	Recovered lubricating oil of salable quality	Still bottoms	Common around World War II, but commercial practice has significantly declined.	Capital-intensive; fuel blending has been a more inexpensive practice.
Waste Oil Recovery-Acid Clay	Addition of acid to break out emulsified water, adsorption of impurities onto clay, followed by filtration.	Waste lubricating oils	Recovered lubricating oil of salable quality	Spend clay sludge	Common around World War II, but commercial practice has significantly declined.	Disposal of large quantities of spent clay as hazardous waste is costly.
Acid Recovery-Crystallization	Chilling acid waste to crystallize iron and recover acid.	Sulfuric acid and hydrochloric acid pickle liquors.	Recovery of acid and a sale iron crystal	No residue	Captive technology well developed.	Can be utilized as a batch or continuous process.
Acid Recovery-Roasting	Dry roasting in kiln with recovery of iron oxide.	Hydrochloric acid pickle liquor	Recovery of acid and a salable high-quality iron oxide.	No residue	Captive technology will developed.	Capital-intensive.
Acid Recovery-SO2 Conversion	Incineration followed by conversion of SO-2 gases to sulfuric acid.	Acid and acid sludges that use sulfuric acid	Recovery of acid	No residue	Commercial	Waste may be solid or liquid; can have up to 90% sulfuric acid, 15% ash, 65% hydrocarbons, and 2% chlorine.
Metal Recovery-Hydrometallurgy	Utilizes a series of unit processes such as acid leaching, neutralization, precipitation, liquid extraction, and ion exchange for selective removal of chrome, nickel, copper, and zinc (with cadmium)	Aqueous liquids with metals; heavy metal solids and sludges.	Recovery of metals	Residue may be a candidate for delisting	Early pilot stage of development	Viability of wastes is based on the value of metals present, mix of contaminants, and concentration of recoverable species.
Metal Recovery-Centralized Ion Exchange	Regeneration of ion exchange units and subsequent recovery of metals.	Aqueous liquids with metals.	Recovery of metals; regeneration of ion exchange units	Residue may be a candidate for delisting	Ion exchange process well proven; no commerical facility in operation.	Separation of metal-bearing wastes required at the source.

TABLE 4-1 (Continued)
SUMMARY DESCRIPTION OF MATERIALS RECOVERY TECHNOLOGIES

Technology	Basic Concept	Suitable Wastes	Recovery Product	Residue	Commerical Status	Capabilities/ Limitations
Metal Recovery-Pyrometallurgy Waelz kiln	Roasting of metal-laden dusts to recover zinc.	Carbon steel electric arc furnace dusts.	Zinc oxide acceptable for secondary smelting.	Solid residue may still contain hazardous levels of lead, cadmium, and chromium.	Commerical	Zinc content must be greater than 20% for process to be economical at this time.
Metal Recovery-Pyrometallurgy Plasmazing	Plasma reduction of metal-dusts.	Carbon steel and speciality steel electric arc furnace dusts.	Prime Western-grade zinc; energy recovery.	Solid residue may still contain hazardous levels of lead, cadmium, and chromium.	Early stages of commercial development.	Zinc content must be than 20 %.
Metal Recovery-Pyrometallurgy Direct Reduction	Agglomeration, thermal reduction, and melting to yield high chrome, high nickel iron alloy.	Electric arc furnace dusts.	Pig product for resale as feedstock.	Hazardous residual	Commercial	Energy-intensive; zinc in flue gas can be recovered.

TABLE 4-2
SUMMARY DESCRIPTION OF ENERGY RECOVERY TECHNOLOGIES

Technology	Basic Concept	Type of Waste Stresses	Residual	State of Development	Capabilities/ Limitations
Incineration in cement and other industrial process kilns (2,200 to 3000°F)	Co-firing as supplemental fuel in manufacture of cement, lime aggregate, and steel.	Pesticides; non-halogenated solvents, blended fuels, other combustible liquids.	Clinker cement product with adsorbed solids and gases.	Several kilns operating	Feed stream must be liquid with few or no solids; high temperature and long residence time achieve high destruction efficiencies; possibly minimal retrofitting requirements.
Fuel blending	Filtration and other phase separation to produce waste-derived fuels for burning in boilers.	Lubricating oils; non-halogenated solvents, and still bottoms with high heating value; certain residuals of waste oil refining and solvent recovery; other combustible liquids.	Solids and impurities removed from the waste fuel.	Commercial	Minimal capital investiment required; recovers heating value of wastes; removal of hazardous air pollutants not closely monitored; future uncertain as proposed regulations prohibit burning of hazardous waste in non-industrial boilers.
Burning in industrial boilers	Combustion in industrial boilers as supplemental or primary fuel.	Blended fuels, non-halogenated waste solvents, solvent still bottoms, waste oils.	Low ash content of fuels may eliminate ash residue.	Common in Industry	Destruction comparable with incinerators for many waste types; ash and metal content of fuels should be limited; presently exempted from regulations but forthcoming regulations will likely restrict burning in small industrial boilers.

TABLE 4-3
SUMMARY DESCRIPTION OF THERMAL DESTRUCTION TECHNOLOGIES

Technology	Basic Concept	Suitable Wastes	Residue	Commercial Status	Capabilities/ Limitations
Liquid injection incineration	Injection of liquids into single chamber incinerator (1,300 to 3000°F).	Organic solvents, paint mixtures, oils, and other combustible liquids; pumpable slurries of above.	Ash residue	Common commercial facility	Low cost incineration historically designed for a specific waste.
Shipboard incineration	Liquid injection incineration on oceangoing vessels (1,300 to 3,000°F).	Same as liquid injection; emphasis placed on highly toxic organics, PCBs, etc.	Ash residue	Practiced in Europe; commercial operations attempting to get permitted in the U.S.	No pollution control equipment required; pumpable wastes only; regulatory climate uncertain.
Rotary kiln incineration	Incineration in rotating cylinder (1,500 to 3,000°F).	Same as liquid injection, plus sludges, solids, and drums.	Ash residue	Commercially available	Capable of incinerating a wide range of wastes.
Multiple health	Spiral descent of wastes over progressively hotter hearth (1,400 to 1,800°F).	Combustible solids and sludges	Ash residue	Commonly used for regeneration of spent activated carbon or incineration of biological waste-water treatment sludges.	Typically designed for one specific waste; combustion gases may contain many products of incomplete combustion due to shorter residence times.
Fluidized Bed Incineration	Combustion of wastes in molten sand bed (1,300 to 2,300°F).	Wide range of liquid organic wastes or sludges.	Solidified melt residue may be hazardous due to high metal content.	Common captive facility; no commercial facility	Well-suited for wastes that cannot be burned by conventional incineration; solids must be pretreated.
Wet Air Oxidation	Oxidation in heated, pressurized vessle (650°F - 3,200 psig).	Aqueous wastes containing organics and cyanides; can recover inorganic chemicals contaminated with organics.		Fifty to sixty captive units in the U.S.; three commercial units.	Well-suited for waste too dilute for incineration yet too toxic for biotreatment.
High-Temperature Fluid Wall Reactor	Radiant heat pyrolysis in an annulus within a lined vertical cylinder (2,200 to 4,000°F).	Any organic material in small particle form, including contaminated soils.	Ash residue	Pilot operation only	High destruction efficiencies; energy recovery; operating temperatures easily controlled; high electrical cost.
Circulating Bed	Turbulent mixing of waste and limestone in vertical combustion chamber (1,400 to 1,600°F).	Chlorinated hydrocarbons, PCBs, oil, sludges, solvents, cyanide potlings	Ash residue	Commercial unit burns coal; being evaluated for use with hazardous wastes.	No air pollution control equipment required.

TABLE 4-4
SUMMARY DESCRIPTION OF CHEMICAL/BIOLOGICAL TECHNOLOGIES

Technology	Basic Concept	Type of Waste Stresses	Residual	State of Development	Capabilities/ Limitations
Chemical Oxidation/ Reduction	Chemcial change of oxidation state of components of waste.	Aqueous stress with organics or inorganics in dilute concentrations (typically cyanide and hexavalent chrome).	Residual liquid waste stress	Commonly used at commercial treatment facilities.	Residual chemicals in product stream may require subsequent treatment.
Neutralization-Precipitation	Adjustment of pH and chemical transformation of dissolved components of solids; flocculation may follow precipitation.	Aqueous or non-aqueous corrosive wastes, aqueous streams with heavy metals.	Heavy metal sludge; supernatant	Commonly used at commercial treatment facilities.	Inexpensive; precipitated solids need to be dewatered and disposed of; some sulfide precipitated solids have been delisted; supernatant may contain residual heavy metals or other precipitative species.
Chemical Dehalogenation	Chemical reduction with metallic sodium.	PCB-laden transformer oils	Emissions are essentially salts not considered toxic	Commercially available	Usually a mobile processing unit; converts chlorine to sodium chloride; very high costs.
Biological Oxidation	Convential biological treatment; e.g., activated sludge	Aqueous stress with dilute organics.	Excess biological solids generated by microorganisms	Commercially available, widely applied.	Nutrients often required; pretreatment required to adjust pH, suspended solids, and concentration of metals and organics in feed stream; low-cost treatment.
Specifically Adapted Bacteria	Biodegradation via addition, in-situ, or specially adapted bacteria/enzymes.	Oils, phenols, hydrocarbons; practically any organic.	Not known	Commercially available, but not widely applied; undergoing testing for more toxic organics.	Treatment done in-situ; bacteria are costly; raise liability issues; will treat only a very narrow spectrum of wastes.
Landfarming	Treatment via natural biologic and other processes in soil medium.	Oil sludges, refinery wastes, contaminated soils.	Adsorbed heavy metals and refractory	Widely applied although less developed for hazardous wastes.	Very dependent on weather; must be considered form of land disposal if waste contains toxic metal.

TABLE 4-5
SUMMARY DESCRIPTION OF PHYSICAL TREATMENT TECHNOLOGIES

Technology	Basic Concept	Type of Waste Stresses	Residual	State of Development	Capabilities/ Limitations
Solids/Liquid Separation-Mechanical	Phase separation processes filtration, centrillugation, etc.	Slurries and/or sludges	Dewatered solids	Common in the pretreatment of waste slurries and sludges.	Volume reduction technology; performance and cost depend on selected techniques but generally inexpensive.
Carbon Adsorption	Selective adsorption of organics by granular activated carbon or powdered activated carbon.	Aqueous wastes with low concentrations or organics and some inorganics.	Spent carbon contaminated with toxics and corrosives.	Frequently applied to treat industrial wastewater; occasionally used at commercial TSD facilities.	Pretreatment of waste stream usually required; good removal of dissolved organics; can be used to recover organics; regeneration of carbon is expensive.
Resin Adsorption	Selective adsorption by synthetic resin.	Aqueous wastes with low concentrations or organics and some inorganics.	Spent resin	In use in captive facilities to treat industrial wastewaters.	Good removal of specific dissolved organics; pretreatment of feed stream often required; materials cost is high.
Emulsion Breaking	Separation of emulsions into two distinct phases through a wide range of alternative methods, primarily using alum, waste pickle liquor, ferric chloride or polymers.	Oil/water mixtures	Solid waste; oil can can be recovered	Various methods are commonly used.	Pretreatment method only.
Volatilization	Removal of specific compounds by distillation, evaporation, stream stripping, or inert gas stripping.	Aqueous or other liquids with organics; slurries or sludges with organics; waste liquids with high dissolved solids.	Still bottoms; dilute aqueous stream requiring further treatment.	Commonly used for recovery of solvents or salts.	Separated components are more amenable to further treatment; essential technology in solvent recovery; processes can function as a batch or continuous operation.
Ion Exchange	Selective removal by liquid/resin or liquid/liquid ion exchange.	Liquid waste with metals or other ionic species.	Residual concentrated solution	Well-developed, but rarely used at commercial waste treatment facilities.	Good recovery technology; expensive; feed streams must be full of suspended matter, surfactants, and oxidents.

TABLE 4-6
SUMMARY DESCRIPTION OF SOLIDIFICATION, STABILIZATION AND FIXATION TECHNOLOGIES

Technology	Basic Concept	Type of Waste Stresses	State of Development	Capabilities/ Limitations
Waste Bulking	Mixing of waste with solid adsorbent material to produce a non-flowable material.	Virtually any type of hazardous waste.	Commercial, many facilities operating in region.	Relatively low cost; wide range of adsorbents may be used to include soil; not really a treatment method.
Cement-Based Process	Chemical reaction between certain waste constituents and Portaland cement to produce a non-flowable material.	Most inorganic hazardous wastes, wastes containing high levels of toxic metals.	Proven technology, numerous patented processes commercially available, some proprietary additives.	Raw materials plentiful and inexpensive; tolerant of waste variations; organics interfere with setting of mix; sulfates retard setting reaction; some treated wastes have been delisted, but long-term mobility of hazardous constituents is unknown.
Thermoplastic Technique (includes bitumen, paraffin, and polyethylene)	Mixing of dried, heated waste with heated plastic matrix to produce an immobilized material.	Inorganic solids and sludges, wastes containing organics.	Commercial applications very limited.	Wastes are immobilized in the polymer matrix; energy-intensive; expensive raw materials.
Organic Polymer Process (typically urea-formaldehyde)	Mixing of waste with prepolymer which then polymerizes, immobilizing the waste.	Virtually any type of hazardous wastes.	Not available at commercial TSD facilities, but fairly well-developed in other applications.	Produces acidic weep water requiring additional treatment; solidified product has lower density than those from similar processes.

TABLE 4-7
SUMMARY DESCRIPTION OF TRANSFER TECHNOLOGIES

Technology	Basic Concept	Type of Waste Stresses	Recovery Product	Residue	Commercial Status	Capability/ Limitations
Waste Exchange	Arranged transfer of wastes from a generator to a party able to use the waste as feedstock.	Usually limited to waste produced on a continuous basis with fairly constant quality.			Numerous exchanges, privately and publicly operated, currently exist.	Minimal capital investment required; wastes must be stored during the processing of information.
Storage/Transfer Options	Transfer of wastes from a generator to a transfer/storage point for processing for eventual transfer to a disposal facility.	All wastes are suitable, both drummed and bulk, although drummed is the most common.	N/A	N/A	Numerous operations, privately and publicly operated, currently exist.	Facility or collection point design is fairly simple; collection of wastes may require extensive organization.

SECTION 5

EVALUATION OF STORAGE/ TRANSFER OPTIONS

SECTION FIVE

EVALUATION OF STORAGE/TRANSFER OPTIONS

Evaluation of hazardous waste processing technology options indicates that present level of demand in the state is not sufficient to support a stand-alone processing facility. Lack of storage/transfer technologies for small generators appears to be the major barrier to effective waste management. This study therefore investigates these technologies in detail in order to determine the feasibility of such options in the state. To do this, specific storage/transfer options must be identified and the market demand for such services identified. Feasibility must then be determined in three ways: operational feasibility, financial feasibility, and the practical feasibility of implementing the identified option.

Storage/Transfer Options

Any transfer/storage facility (T/S) design must address a number of factors relative to three areas of concern: the generators involved, daily operations, and economic feasibility. The factors to be addressed are the following:

- Educated or "real" market size. Development of any T/S facility to serve small generators will require an education program performed at the same time. The market segment served by a T/S facility will be generators who know and understand its purpose. Therefore, market size will depend on both the waste quantities present and generators' understanding of good management methods;

- Waste mix. The range of both types of wastes and types of generators that a facility will handle will determine the physical and operational steps needed to handle potential incompatible wastes and the level of laboratory testing required to adequately characterize those wastes;

- Available financing. Past experience indicates that the requirement for a facility to be independently profitable will greatly affect the extent of service it can provide to geographically isolated groups of small generators. If such groups of generators exist, a design which minimizes

transportation costs may be necessary, as well as additional financial support to ensure that all generators are served;

- <u>Present regulations</u>. Physical layout and daily operations of any T/S facility must conform to all applicable federal, state, and local regulations; and

- <u>Transportation</u>. Scheduling of waste pickups to accommodate varying or intermittent quantities of waste, incompatible wastes and the existence of isolated groups of small generators will involve varying levels of complexity.

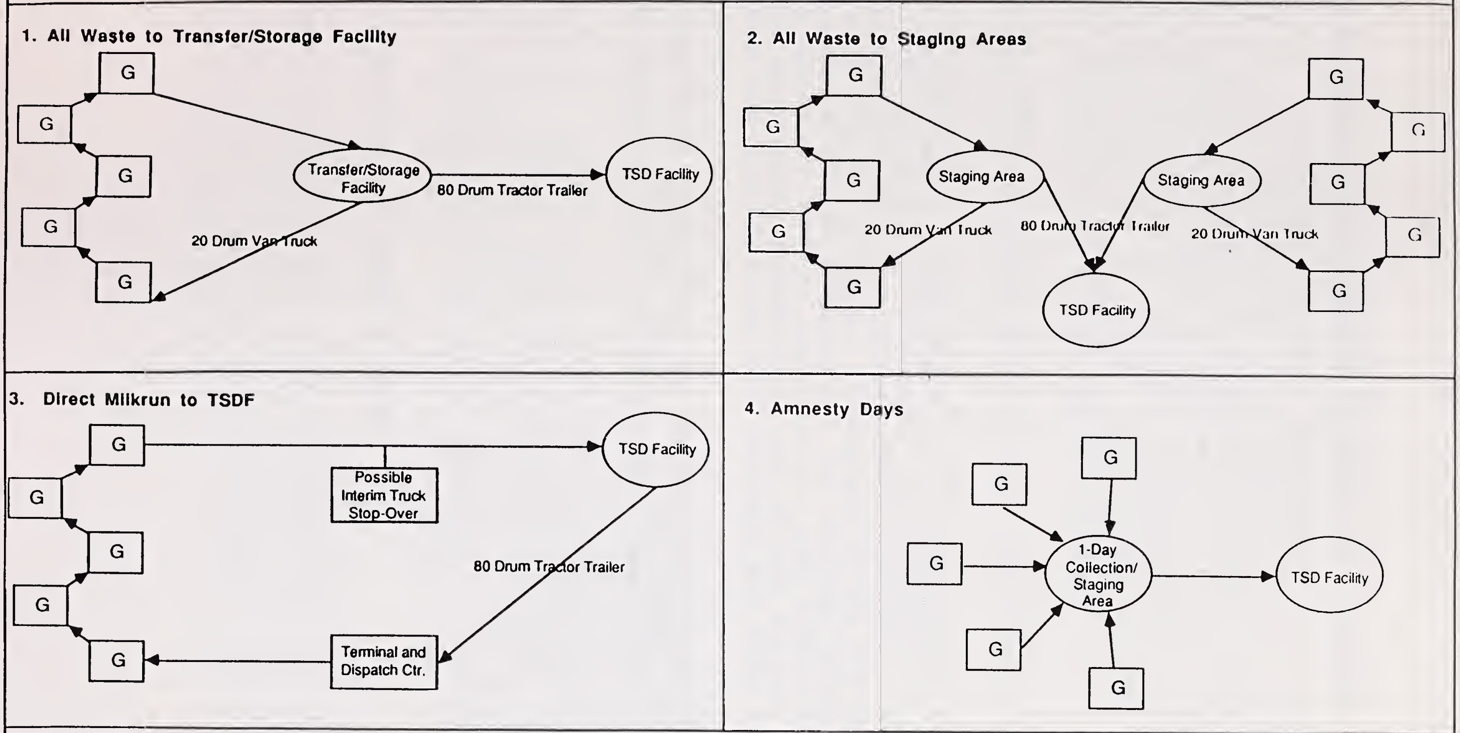
While all T/S facility designs address these factors in a number of ways, one common axis exists along which all designs can be placed: the centralized/decentralized nature of the waste management system. The factors listed above will determine the requirements of the system, which will dictate whether a centralized or decentralized approach is to be taken. This approach, in turn, will dictate the physical features, unit operations, and associated costs of any one T/S facility. The decision process, however, will not be a straight line one, but an iterative one; that is, market and service factors will lead to a centralized/decentralized approach, the economic viability of the system will be considered, and the approach may then be re-adapted.

Four storage/transfer concepts were selected for evaluation, including the following:

- collection with a transfer/storage (t/s) facility
- collection with staging areas (permanent facilities at which waste is stored for only 10 days at a time)
- collection with direct transport to out-of-state tsd facility
- amnesty days

These concepts are illustrated in Figure 5-1.

Figure 5-1
Storage/Transfer Concepts Used in the Montana Study



KEY

G Generators

TSD Licensed Hazardous Waste Transfer, Storage, and/or Disposal Facility

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Collection with a Transfer/Storage (T/S) Facility

This approach is similar to plans implemented by a number of currently operating facilities. It assumes that all hazardous wastes will be collected in 55-gallon drums designed to meet DOT specifications for transport of hazardous wastes; drums may be provided to the SQGs as part of the service package (i.e., each full drum collected may be replaced with an empty drum). The drums will be collected in 14-foot trucks with a capacity of approximately 5.5 tons, or 21 drums. Each truck will have a lift gate and will be staffed with one service employee. It is assumed that the drums will be 80% full on average.

All collected waste is transported to an interim T/S facility before transport to a treatment facility for final disposition.

Physical size of the T/S facility may vary significantly due to the storage requirements. Regardless of facility size, however, such a facility consists of a storage area, loading facilities, drum staging/testing area, and office/laboratory space. Staffing personnel will depend on annual throughput of the T/S facility, but will generally consist of personnel for loading/ unloading, a laboratory director and/or technician, and administrative personnel for management, scheduling, and office duties. It is assumed that the T/S facility will satisfy all RCRA facility standards.

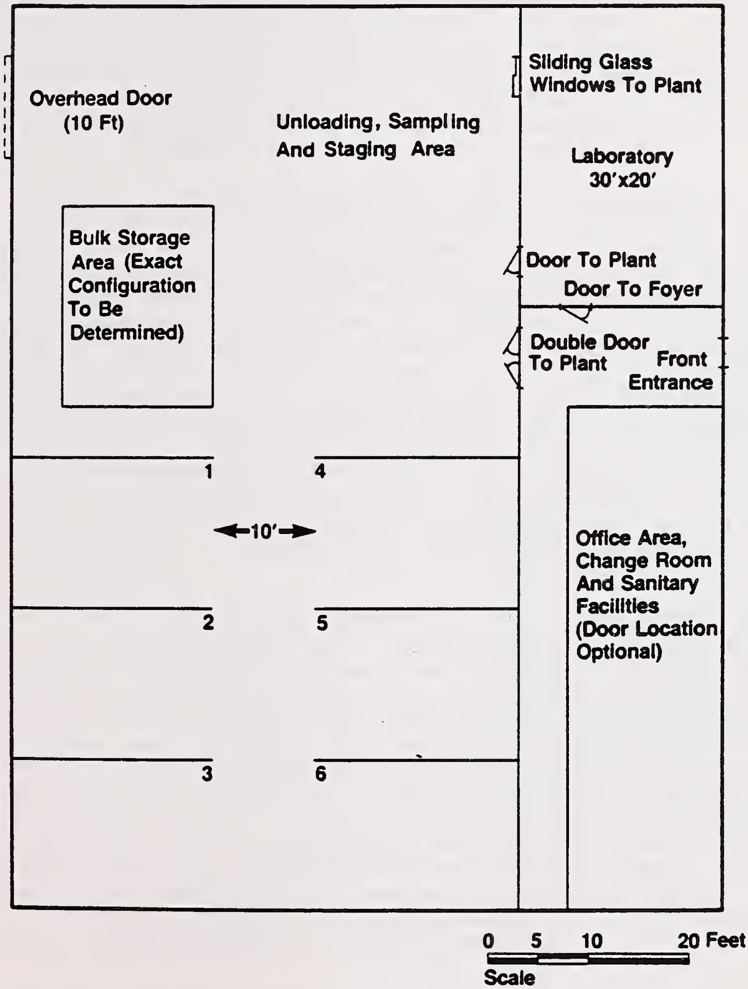
Since the hazardous wastes will be contained in individual drums and the collection trucks are enclosed, it is assumed that drums from various generators can be hauled in the same vehicle.

Wastes that are known to be incompatible can be collected on separate runs. The time between service for each SQG is dependent on the amount of waste produced by the SQG. However, any SQG desiring service will be served within a 270-day period. Waste is transported from the T/S facility to final disposition in flat bed trailers with 80-drum capacity. A generalized schematic of a T/S facility is presented in Figure 5-2.

Collection with Staging Areas

Collection systems are similar to those for the T/S facility option; however, numerous small staging stations are utilized for storage and subsequent reloading instead of a central T/S facility. These staging areas are non-permitted facilities; to satisfy this status, waste may only be stored at them for ten days or less. They are typically by nature less sophisticated

Figure 5-2
Generalized Schematic Waste Transfer Facility



Notes:

1. Local Fire Codes May Prohibit Storage Of Bulk Flammable (Flash 100 F-PMCC) Materials Inside The Building.

2. Each Compatible Waste Storage Area Is 20'x15' And Will Hold 24 55 Gallon Drums On Standard Pallets, Double Stacked. The Row Of Drums Will Have 5 Ft. Aisles All Around

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than a central T/S facility and may not require full-time personnel depending upon the operation plan implemented.

In the 1987 Montana legislature, the regulations concerning facilities that will store hazardous waste for ten days or less were modified to require that performance standards be met. These standards are being finalized by the DHES, with final review and approval to be completed in the coming year. The performance standards for these 10 day or less "staging" facilities will include requirements for training, contingency planning, site security requirements, container handling stipulations, and a public hearing prior to opening.

Physical size of a staging facility will be dependent upon a specified amount of waste requiring unloading/reloading. Either the size of the staging area itself or the frequency of collection can be varied to accomodate a specified amount of waste. A staging area is conceived to include loading facilities and a drum storage/regrouping area. No laboratory facilities are present, and no waste can be stored at the facility outside of the 10-day time window of operation. Staffing personnel will depend on throughput per collection event as well as the frequency of collection events per year, but will generally consist of personnel for loading/unloading and administrative personnel for management, scheduling, and office duties. The staff may be full-time or part-time. The physical nature of a staging area is less defined than that of a central transfer facility, due to lack of regulatory specifications because of its non-permitted status.

Due to the 10-day limit for operation of a staging area, the collection area may be smaller than that of a central T/S facility; it is therefore assumed that a number of staging areas across the state would be necessary. Drums are collected from generators in 14-foot trucks and, after sorting and regrouping at the staging area, are transported for final disposition in flat bed trailers. It is assumed that incompatible waste can be collected in separate runs. It should be noted, however, that because facilities for detailed testing are not present, generator manifest forms will comprise the main information on which incompatability determinations will be made. The time between service for each SQG is dependent upon the scheduling of collection events. However, it is assumed that any SQG desiring service will be served within a 270-day period.

Collection with Direct Transport to Out-of-State TSDF

In this option, initial collection and transport to a TSDF are performed by a single vehicle in a single trip, with no storage or reloading occurring during the process. Collection occurs with an 80 drum capacity flat bed trailer.

Physical facilities for this option consist of a central terminal from which trucks are dispatched and maintained. The size of the facility is dependent upon the number of trucks in the system. Staffing personnel is dependent upon the number of collection trucks and the frequency of collection events, but generally consists of professional personnel for scheduling and administrative personnel for management and office duties. Because waste is collected from generators and transported to final disposition within the same truck, precise scheduling and planing is required. Although incompatibles from generators can be collected in the same truck, these wastes must be destined for the same final licensed treatment/disposal facility. The time between service for each SQG is dependent upon the scheduling of collection events. However, it is assumed that any SQG desiring service will be served within a 270 day period.

Amnesty Days

This option refers to government funded hazardous waste collection programs for households, farmers, schools, state agencies, and small businesses. Collection and disposal of waste out-of-state is contracted out to a private, bonded waste handling company. Government provides only the scheduling and arrangement services connected with such an operation.

Physical facilities for this option consist only of an area large enough and accessible enough for drop-off of wastes by a large number of individuals. Since waste may come from households as well as small businesses, the amount of waste expected is impossible to estimate. The area must also be acceptable to the contracted waste handling company, as well as local citizens.

Waste is generally accepted for one day only, although longer periods can be accommodated as long as the 10-day limit for non-permitted storage sites is recognized. Waste is accepted with "amnesty", i.e., generators are not required to identify themselves or the origin of their waste. Limited testing is performed only to accommodate safe bulking of waste. The waste collected at such an event is usually destined for incineration, since little information about the origin or type of waste is

available. Staffing usually consists of a number of volunteers as well as waste handling professionals provided by the contracted waste handler. Amnesty Day events are usually held once or twice a year; they are therefore not frequent enough to accommodate the disposal needs of most SQGs.

Operational Feasibility

The operational feasibility (advantages/disadvantages) of each option is presented in Table 5-1. Due to consideration of the balance of advantages/disadvantages of each option, collection with direct transport to a TSD facility and the Amnesty Days options were excluded from further analysis. The inaccessability of some generators in Montana to these options, their unflexible nature, and the loss of critical educational and safety factors make them unacceptable for consideration at this time.

Market Demand

Potential market demand scenarios were developed in order to indicate various levels of service for which financial feasibility of the remaining storage/transfer technologies could be evaluated; the range of demand scenarios is presented in Figure 5-3. The extrapolated estimates of statewide waste generation by SQGs and VSQGs are used to calculate the demands. Four possible scenarios were selected to calculate various levels of demand:

- All hazardous wastes from both SQGs and VSQGs would be collected;
- All hazardous wastes from SQGs only would be collected;
- Hazardous wastes, minus solvents, from both SQGs and VSQGs would be collected; and
- Hazardous wastes, minus solvents, from SQGs only would be collected.

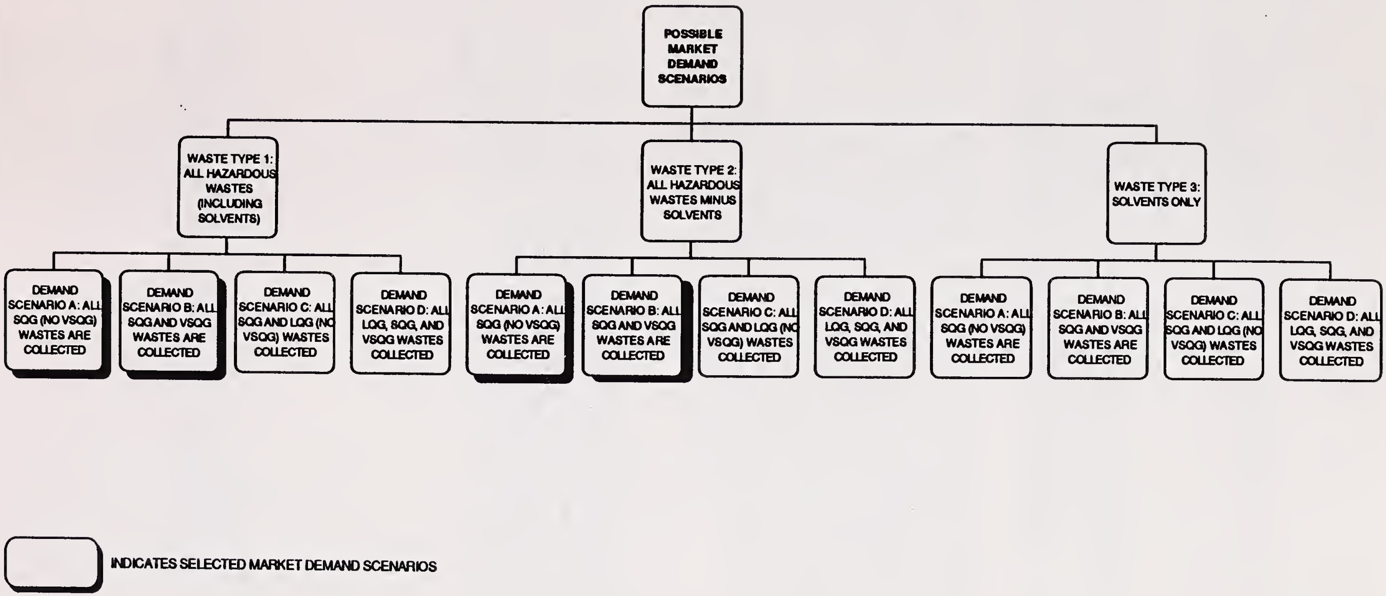
These four scenarios represented calculated demands of 6192, 3744, 2923, and 2160 drums of waste, respectively and are thought to represent the "best-" and "worst-case" conditions, i.e., the most and least amount of waste available spread over a wide geographic range. These demands are based on extrapolated estimation of waste generation only and do not take into account regulatory, financial, institutional, or other factors.

Table 5-1
Comparison of Operational Feasibility of Storage/Transfer Options

COLLECTION OPTION	COLLECTION/ SCHEDULING	ENCOURAGEMENT OF GENERATOR USE	TRANSPORT OF INCOMPATIBLES	BROKERING OF WASTES	ASSURANCE OF COMPLIANCE
T/S FACILITY					
Advantages	Planning of pickups is flexible due to storage. Van trucks allow lower cost for unplanned pickups. Storage allows for emergency pickups.	Permanent facility and staff allows constant contact with generators. Tangible facility encourages use by generators.	Van trucks allow separate runs for incompatibles. Facility allows storage until compatibles can be transported together. Fingerprint testing capability insures safe transport to TSDF.	Storage allows sufficient quantity to be accumulated for direct shipment to ultimate TSDF at negotiated prices (brokering).	Permitting authority over facility insures compliance.
Disadvantages		Facility being in just one geographic location may not encourage use by distant generators. Collection system will be necessary.			
STAGING AREAS					
Advantages	Staging area allows some sorting of drums	Local staffing allows closer contact with more generators.	Van trucks allow separate runs for incompatibles. Staging area allows compatibles to be sorted for transport to TSDF.	Modest opportunity for brokering.	
Disadvantages	Pickups must be well planned in advance due to 10 day "window".	Simple nature of staging areas does not afford high visibility.	Absence of central testing cannot assure proper identification of compatibles for transport to TSDF. Must rely on driver to make determination.	Most waste shipped to single TSDF who would, in turn, broker to other TSDFs. Would most likely result in higher drop charge.	Federally non-permitted status of staging areas does not allow control of procedures and practice; however, new Montana statute does allow stricter interpretation of this non-permitted status.

COLLECTION OPTION	COLLECTION/ SCHEDULING	ENCOURAGEMENT OF GENERATOR USE	TRANSPORT OF INCOMPATIBLES	BROKERING OF WASTES	ASSURANCE OF COMPLIANCE
DIRECT MILKRUNS (WITH 80 DRUM SEMI-TRAILER TRUCK)					
Advantages		Permanent staffing of terminal allows constant contact with generator.		Little opportunity for brokering.	
Disadvantages	Advance planning of pickups is critical. Emergency or unplanned pickups will be costly due to operations cost of truck.	Large semi-trailer truck may inhibit access to some generators. Staffing in just one geographic location may not encourage use by distant generators. Absence of handling leads to perception that all waste can be stored/transported together.	Separate runs for incompatible wastes will greatly increase cost. Compatibility of wastes transported to TSDF cannot be assured due to lack of central testing. Must rely on driver to make determination.	Probably all waste shipped to single TSDF. Would most likely result in higher drop charges.	Non-permitted status of "system" or terminal does not allow control of procedures and practice.
AMNESTY DAYS					
Advantages	Collection day is scheduled well in advance.	No regulatory enforcement involvement.		Little opportunity for brokering.	Contracted TSD service can be investigated and contracted to perform service correctly.
Disadvantages	No flexibility in collection is provided for; emergency or unplanned pickups are non-existent. Generator must transport waste.	"Amnesty" does not allow generators to be identified for education or assistance efforts.	Generator may be transporting incompatibles unknowingly.	Probably all waste shipped to single TSDF. Would most likely result in higher drop charges.	Does not provide incentive for SQGs to learn and follow regulations that otherwise apply to them.

Figure 5-3
Possible and Selected Market Demand Scenarios



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Financial Feasibility

In order to determine the financial feasibility of the two storage/transfer options indicated, the following cost breakdown was required for each option:

- facility capital costs;
- facility O&M costs;
- collection system capital costs (includes breakdown between collection of waste from generators and transfer to an out-of-state TSD facility);
- collection system O&M costs (same breakdown); and
- disposal facility drop charge.

Estimation of facility capital and O&M costs was based on waste quantities estimated under each of the demand scenarios. Estimation of collection system capital and O&M costs required economically optimized routing of trucks over the entire state on a county-by-county basis, using waste quantities for each county estimated under each of the demand scenarios. These costs are presented for each alternative in Table 5-2 and Figure 5-4.[1] A cost comparison of the system options is presented in Figure 5-5. The range of demand, estimated by the consultant to represent a reasonable future forecast of waste actually available, is presented as a band on this Figure.

Summary

As indicated in Figure 5-5, both system options appear to be feasible compared to existing management costs incurred by SQGs, with the T/S facility option having slightly lower total system costs per drum. This lower cost, in conjunction with various operational and educational advantages when applied to Montana, recommend the T/S facility option to be considered for implementation in Montana.

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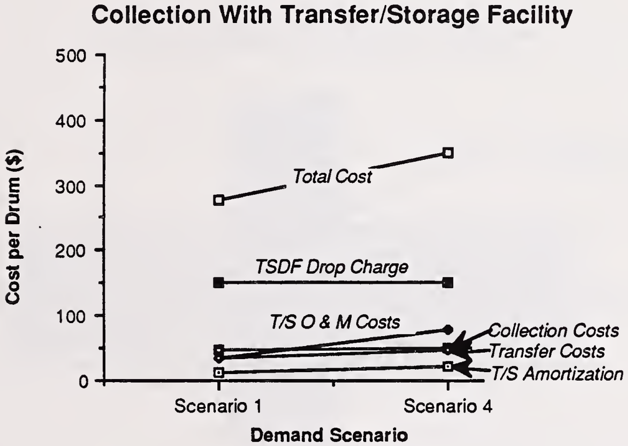
[1]Complete documentation of the routing process used, as well as detailed cost estimates for each option and the costing procedures used, is available in a separate appendix to this report and can be obtained from DHES personnel by special request.

Table 5-2
Financial Feasibility Cost Summary

	T/S STATION OR STAGING AREA			COLLECTION AND TRANSFER SYSTEM							
					AMORTIZATION OF CAPITAL		O & M COSTS				
COLLECTION OPTION/ DEMAND SCENARIO	CAPITAL COSTS	AMORTIZATION OF CAPITAL (COST/DRUM)	O&M COSTS (COST/DRUM)	CAPITAL COSTS	FOR COLLECTION (COST/DRUM)	FOR TSDF TRANSFER (COST/DRUM)	FOR COLLECTION (COST/DRUM)	FOR TSDF TRANSFER (COST/DRUM)	TSDF DROP CHARGE* (COST/DRUM)	NUMBER OF DRUMS	TOTAL ANNUAL COST (COST/DRUM)
OPTION 1 - TRANSFER STATION CONCEPT											
DEMAND SCENARIO 1: ALL HAZ WASTE, SQG+VSQG	$653,835	$71,646 ($12)	$209,760 ($34)	$278,760	$45,831 ($7)	$34,742 ($6)	$240,128 ($39)	$185,963 ($30)	$927,450 ($150)	6183	$1,715,520 ($277)
DEMAND SCENARIO 4: HAZ WASTE MINUS SOLVENTS, SQG ONLY	$453,375	$49,681 ($23)	$168,423 ($78)	$173,880	$17,220 ($8)	$12,182 ($6)	$94,007 ($44)	$87,709 ($41)	$324,000 ($150)	2160	$753,222 ($349)
OPTION 2 - STAGING AREA CONCEPT											
DEMAND SCENARIO 1: ALL HAZ WASTE, SQG+VSQG	$578,825	$63,410 ($10)	$488,175 ($79)	$173,880	$15,937 ($3)	$38,303 ($6)	$90,262 ($15)	$200,313 ($32)	** $1,082,025 ($175)	6183	$1,978,425 ($320)
DEMAND SCENARIO 4: HAZ WASTE MINUS SOLVENTS, SQG ONLY	$578,825	$63,410 ($29)	$378,293 ($175)	$138,920	$7,313 ($3)	$12,985 ($6)	$46,392 ($21)	$92,081 ($43)	** $378,000 ($175)	2160	$978,474 ($453)

* Based on a median disposal charge of $150/drum
** Includes minimum charge for fingerprint testing

Figure 5-4
Cost Breakdown for Storage/Transfer Options for Demand Scenarios 1-4



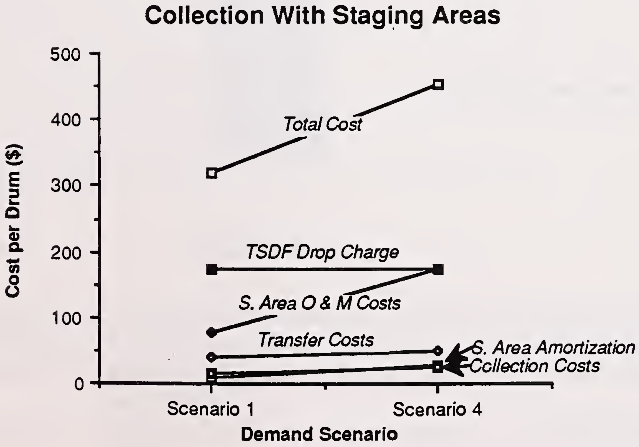


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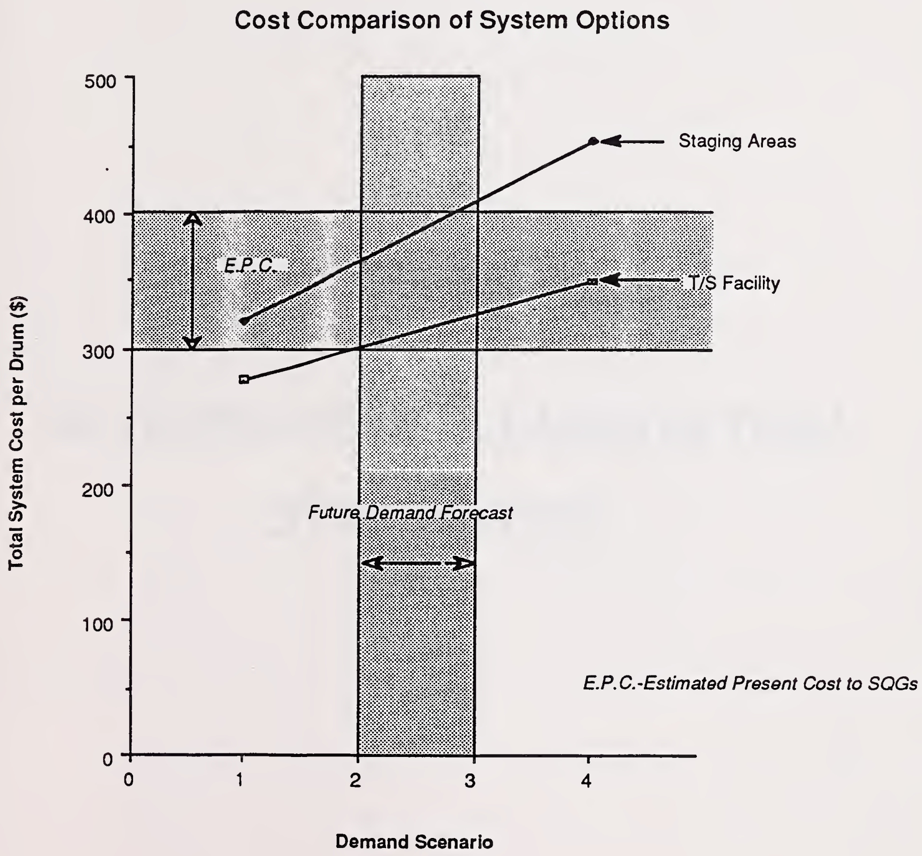
Figure 5-5
Comparison of Total System Cost of Storage/Transfer Options for Demand Scenarios 1-4



Demand Scenario 1: All hazardous wastes from SQGs and VSQGs are collected.
Demand Scenario 2: All hazardous wastes from SQGs only are collected.
Demand Scenario 3: Hazardous wastes, minus solvents, from SQGs and VSQGs are collected.
Demand Scenario 4. Hazardous wastes, minus solvents, from SQGs only are collected.

SECTION 6

ALTERNATE IMPLEMENTATION STRATEGIES

SECTION SIX

ALTERNATE IMPLEMENTATION STRATEGIES

Identification of the need for storage/transfer technologies for proper management of hazardous waste in Montana leads to consideration of several possible implementation options to fulfill that need. After reviewing various possible options, it was determined that three basic implementation strategy options should be evaluated. These include the following:

- state-owned, state-operated storage/transfer system
- state-owned, privately-operated storage/transfer system
- privately-owned, privately-operated storage/transfer system

During the review process conducted by the DHES and legislative session on the draft material submitted in January 1987, the relatively high costs identified in the draft report for disposal of small and very small quantity generator wastes initiated discussion of the option of the state providing subsidies. As a result of these discussions, two subsidy options were added to the analysis, including the following:

- privately-owned, privately-operated storage/transfer system with subsidies to the contractors responsible for collecting and disposing of the hazardous wastes, and

- privately-owned, privately-operated storage/transfer system with subsidies to generators.

For these five basic options, the consultant analyzed characteristics for a number of key factors. These factors include the following:

- regulatory authority
- level of education/technical assistance
- costs and financing
- acceptance (by public, generators, etc.)
- rate of compliance
- liability
- protection of human health and the environment

These factors are thought to represent the major categories of characteristics for which a decision regarding a choice of options should be based.

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Included in the following text is an evaluation identifying the major advantages and disadvantages of each factor for the five implementation options. At the conclusion of this analysis is a summary which includes a ranking of the options.

STATE-OWNED, STATE-OPERATED SYSTEM

Description

The state-owned, state-operated option refers to the ownership and operation of a T/S facility and collection system by a state agency or board. The state would therefore have responsibility for the siting, design, permitting, construction, and operation of a T/S facility(ies); the organization, stocking and operation of a statewide collection system; the negotiation and payment of charges and fees for utilization of licensed hazardous waste disposal sites for final disposal; and the purchase of equipment for and operation of a transfer system to transport the waste from the transfer facility(ies) to the ultimate disposal sites.

Advantages/Disadvantages

Regulatory Authority

Advantages

Additional funds for enforcement and inspection actions would most likely be minimal since the State could operate the facility(ies) and equipment.

Disadvantages

Co-mingling of the operation of a hazardous waste facility with present enforcement duties is not advisable because currently regulated generators may be alienated. A separate agency, subgroup, or board should be installed to oversee the operation of the program. Such institutional measures as these may be difficult. Joint permitting and inspection duties would have to be performed by both the U.S. EPA and DHES. DHES would most probably be required to defer most of its power in these functions to the U.S EPA. DHES would be setting a precedent for the siting, design, and operation of a hazardous waste management facility.

Education and Technical Assistance

Advantages

Education and technical assistance could be guaranteed for generators, because the State must provide such services. Small generator input to regulatory process would be enhanced due to the

presence of State personnel familiar with their concerns, problems, etc.

Disadvantages

Education and technical assistance efforts may be hampered by generators' perception that possible enforcement actions may result. Any education and assistance efforts should be administered by a branch of the State government separate from enforcement responsibilities.

Costs and Financing

Advantages

Funding for the project would be by direct appropriation, thereby eliminating the need for payment of interest on retired capital investment. This cost would therefore not be passed on directly to the generator.

Disadvantages

This option involves a high initial financial commitment from the State, as well as potential continued support, depending upon the economics of operation and the fees charged. Operation of the facility and the collection system will not benefit from free-market experience. Competition with private enterprise for larger generators in close proximity would exist; inability to capture these generators could result in higher unit costs for the remainder.

Acceptance

Advantages

Public acceptance of this option should be high, due to the perceived role of the State in protecting human health and the environment. Transporter and TSDF acceptance should be high as well, because of the State's regulatory knowledge. Siting of the facility is more likely to succeed if performed by the public sector.

Disadvantages

Generator acceptance of this option may be low, depending on the perceived relationship between the controlling State agency and the enforcement branch.

Rate of Compliance

Advantages

Compliance of the T/S facility and the collection system to state and federal standards could be guaranteed. Rate of compliance of generators could be high as well. Service to all generators could be guaranteed.

Disadvantages

Rate of compliance will be greatly dependent upon accompanying enforcement, education, notification, and technical assistance efforts.

Liability

Advantages

The State is exempt from Federal insurance requirements, as well as the need to guarantee closure costs. The State has a self-insurance program with $10 million coverage in-place.

Disadvantages

No prior legal experience is available on State liabilities at a State-owned and operated hazardous waste facility.

Protection of Public Health and the Environment

Advantages

Protection would be high, due to State's mandate to provide such protection.

Disadvantages

Conservative approach to operations in terms of safety may increase costs. State has limited hands-on experience in the handling and collection of hazardous wastes. The DHES did conduct an Amnesty Days-type program in 1984.

Previous Experience

No State-owned, State-operated hazardous waste facilities are known to be currently operating in the U.S. Such a system is operating in Denmark; it involves coordination of a number of State-owned systems, including rail transport.

STATE-OWNED, PRIVATELY-OPERATED SYSTEM

Description

The state-owned, privately-operated option is an alternative under which the state is responsible for the siting, design, and construction of the T/S facility(ies), as well as the development of a bid specification document and the receipt of bids from private enterprise to provide the necessary equipment, manpower, etc., for the following services: operation of a statewide collection system; operation of the state-owned transfer facility(ies); operation of the transfer system to transport the wastes from the transfer facility(ies) to the alternate disposal sites; and all necessary negotiations and payment of fees to utilize licensed hazardous waste disposal sites for final disposal.

The state would be responsible for administering the contract, and the private firm(s) would be responsible for providing the specified equipment and services. The bid

document would include a specified schedule of rates, based on waste types, distance from pre-established waste generator centroids, etc. The specifications would outline various mandatory stipulations concerning schedules, manpower, equipment, and mandatory service for all generators who requested it according to the rate schedule completed in the bid document. The contractor would also be responsible for collecting the fees from the generators.

Advantages/Disadvantages

Regulatory Authority

Advantages

DHES could continue in its current regulatory role. Installation of another branch of government would not be required.

Disadvantages

Joint permitting and inspection by the U.S. EPA and DHES would be required; duties would have to be well defined. It is expected that DHES would defer much of its power to the U.S. EPA for the permitting of the T/S facility(ies). DHES will be setting a precedent for siting and design of a hazardous waste facility.

Education and Technical Assistance

Advantages

Education and technical assistance could be required through the bid specifications. Small generator input to regulatory processes would be enhanced due to the presence of State personnel familiar with their concerns, problems, etc.

Disadvantages

DHES would most probably have to be involved to some degree, since private contractors will have little interest in generator education unless specifically required in the bid document.

Costs and Financing

Advantages

Funding for the construction of the T/S facility would be by direct appropriation, thereby eliminating the need for payment of interest on retired capital investment. This cost would therefore not be passed on. Operation of the facility will benefit from free-market factors; continued funding would possibly not be needed.

Disadvantages

This option requires a sizeable financial commitment.

Acceptance

Advantages

Public acceptance of this option should be high, due to the perceived role of the State in protecting human health and the environment. Transporter and TSDF acceptance should be high as well, due to regulatory knowledge of the State. State siting and permitting of a facility would greatly enhance the attractiveness of the system to private contractors. Cooperation between government and industry interests toward solution of SQG concerns would be greatly enhanced.

Disadvantages

The possibility of the appearance of conflicts of interest exists between government and industry concerns, due to perceived differences in motives.

Rate of Compliance

Advantages

Compliance of the T/S facility(ies) to state and federal standards could be guaranteed. Bid specifications could require operation to comply with all standards as well. Service to all generators in the state could be required through bid specifications.

Disadvantages

Increased inspection and enforcement efforts by transportation authorities may be necessary to ensure proper operation of the collection system.

Liability

Advantages

The State is exempt from insurance requirement, as well as the need to guarantee closure costs. The State has a self-insurance program with $10 million coverage in-place.

Disadvantages

No prior legal experience is available on State liabilities at a State-owned hazardous waste facility. A clear definition in bid documents will be necessary to delineate responsible parties for insurance.

Protection of Public Health and the Environment

Advantages

Protection would be high, due to State's mandate to provide such protection. Established firms in the waste management industry are experienced in the collection and handling of hazardous wastes. Potential success in siting of the facility is greatly enhanced when done by the public sector.

Disadvantages

Responsible state entity would be obligated to provide emergency services in the event of labor disputes or economic hardship on the contractor.

Previous Experience

Siting commissions (public sector groups empowered with siting responsibilities and powers) exist in a number of states; commissions actively pursuing the siting process are New Jersey and Minnesota. Arizona and Alberta, Canada are currently in the process of constructing hazardous waste facilities which are a public/private ownership mix. Western European nations have reported successful arrangements as well.

PRIVATELY-OWNED, PRIVATELY-OPERATED SYSTEM

Description

The privately-owned, privately-operated option is an alternative under which private industry is responsible for the siting, design, construction, and operation of any needed transfer/storage facilities, as well as the collection system. The state's responsibilities would be limited primarily to enforcement duties.

Advantages/Disadvantages

Regulatory Authority

Advantages

DHES would continue in its current regulatory role. Installation of another level of government would not be required for administrative purposes.

Disadvantages

Compared to other options, increased manpower within DHES for enforcement and inspection duties under this option would probably be required. Regulation of costs, number of transporters, etc., will be difficult unless new regulations or points of control are promulgated.

Education and Technical Assistance

Advantages

Some experienced hazardous waste management firms are likely to have already encountered a wide range of problems associated with small and very small quantity generators.

Disadvantages

DHES would most probably have to continue this service, since private contractors will have little interest in generator education and since no regulation exists requiring this service to be provided.

Costs and Financing

Advantages

No state funding is required for this option. Operation of the facility will benefit from free-market factors.

Disadvantages

Costs will have to include interest on all capital investments, since funding would be secured through private enterprise and lending institutions. This cost will be passed on to the generator. Guaranteed closure costs will also have to be provided by private industry. Costs to generators cannot be guaranteed.

Acceptance

Advantages

Some generators who have complied for some time with hazardous waste regulations may already have established relationships with private waste management firms. Arrangements with TSDFs may already exist.

Disadvantages

Public acceptance may be low, due to typical opinions of private firms. TSDF and transporter acceptance will depend on previous experience and track records of private firms of interest. Siting of a facility by private industry is highly problematic and is considered a large business risk due to its historical high rate of failure.

Rate of Compliance

Advantages

Private waste management firms have compliance histories which can be checked and flagged for potential problems.

Disadvantages

Service to all generators in Montana would most probably not be available at all, or would exist at prohibitive cost to the generator. Compliance of a private storage/transfer operation with existing federal regulations can be guaranteed only as much as enforcement capabilities exist.

Liability

Advantages

Liability of private waste management firms is well established.

Disadvantages

Potential liability from improper disposal will most probably be conveyed through market forces, a rather slow process. Private industry will be subject to

all insurance requirements, which are difficult to fulfill.

Protection of Public Health and the Environment

Advantages

Established firms in the waste management industry are experienced in the collection and handling of hazardous wastes.

Disadvantages

Illegal disposal by small and very small generators most likely be encouraged, due to the expected high cost that will be presented to distant generators.

Previous Experience

The existing waste management marketplace primarily consists of privately-owned/privately-operated facilities and services. The record of these operations is mixed; siting becomes increasingly more difficult. Only a handful of hazardous waste facilities have been successfully sited in the past three years; of these, very few were sited by private industry.

PRIVATELY-OWNED, PRIVATELY-OPERATED SYSTEM, WITH SUBSIDY TO CONTRACTORS

Description

Two types of subsidies are possible under the title of this option; an initial subsidy given to a private waste management firm for coverage of initial facility costs such as design, construction, or permitting, and annual subsidies given to private waste management firms to help defray the costs of waste collection and management in areas or situations where it would be otherwise uneconomical. The State would not provide the services or facilities.

A subsidy of the first type was provided by the Minnesota Waste Management board to a private company to conduct a study on the feasibility of constructing and operating a facility for small quantity hazardous waste generators with limited waste management options in the state. The grant ($350,000) was awarded to National Electric based on their track record, resources to bring to the study, and quality of proposal. The company concluded that a transfer/storage facility was needed in the state and is financing the permit development with the unused remainder of the $350,000 grant.

While an initial subsidy could be examined for applicability in Montana, this type of option is already investigated within the scope of the state-owned, privately-operated option. The second type of subsidy, an annual appropriation to selected contractors to offset high

management costs, is expected to be applicable in Montana because of generators in distant parts of the state and the non-proximity to TSDFs. This type of subsidy is therefore investigated under this option.

For this analysis it is anticipated that the DHES would receive funds from the state legislature each biennium. A contractor application procedure would be initiated, with ultimate subsidy awards being used to partially offset loss of income due to an artificially uneconomically low cost of disposal charged to generators. The exact process of criteria for dispersing the subsides would have to be developed prior to implementation of the program.

Advantages/Disadvantages

Regulatory Authority

Advantages

DHES could continue in its current regulatory role. Installation of another branch of government would not be required for administrative purposes.

Disadvantages

Compared to other options, increased manpower within DHES for enforcement and inspection duties under this option would probably be required. Regulation of costs, number of transporters, etc., will be difficult unless new regulations or points of control are promulgated. Manpower for appropriation secural from each legislative session would be required.

Education and Technical Assistance

Advantages

Some hazardous waste management firms are likely to have experience in a wide range of SQG problems. Annual subsidy requirements could include guarantees that private contractors provide such services.

Disadvantages

DHES would most probably have to continue this service, since private contractors will have little interest in generator education and no regulation exists requiring this service to be provided.

Costs and Financing

Advantages

Operation of the facility will benefit from free-market factors.

Disadvantages

Costs will have to include interest on all capital investments, since funding would be secured through private enterprise and lending institutions. This cost will be passed on to the generators.

Guaranteed closure costs for licensed transfer/storage facilities will also have to be provided by private industry. Costs to generators cannot be guaranteed. Administrative expenses resulting from development of criteria for selection of private company(ies) to subsidize, funding/spending oversight, subsidy review, etc., will exist. Subsidies may require a sizeable appropriation each legislative session.

Acceptance

Advantages

Some generators who have complied for some time with hazardous waste regulations may already have established relationships with private waste management firms. Arrangements with TSDFs may already exist.

Disadvantages

Public acceptance may be low, due to existing opinions on priorities of private firms. TSDF and transporter acceptance will depend on the previous experience and track record of the private firm of interest. Siting of a facility by private industry is highly problematic, and is considered a large business risk due to its historical high rate of failure.

Rate of Compliance

Advantages

Private waste management firms have compliance histories which can be checked and flagged for potential problems. This option would provide waste collection service in previously unserviced areas.

Disadvantages

Compliance of a private storage/transfer operation with existing federal regulations can be guaranteed only as much as enforcement capabilities exist. For SQGs, there is no emphasis on waste reduction at the source. In fact, this option would most likely encourage, not discourage, waste generation.

Liability

Advantages

Liability of private waste management firms is well established.

Disadvantages

Potential liability from improper disposal will most probably be conveyed through market forces, a rather slow process. Private industry will by subject to all insurance requirements, which are difficult to fulfill.

Protection of Public Health and the Environment

Advantages

Established firms in the waste management industry are experienced in the collection and handling of hazardous wastes.

Disadvantages

Private industry is not mandated to protect human health and the environment.

Previous Experience

As noted before, no current experience with this type of subsidy is known.

PRIVATELY-OWNED, PRIVATELY-OPERATED SYSTEMS, WITH GENERATOR SUBSIDIES

Description

This option is one in which the state would not provide any facilities or services, but would operate a grant program to individual generators. The state would set a reasonable cost to generators for waste management; if an individual's cost is more than this limit, a grant would possibly be made available to pay the difference, depending upon the funds appropriated by the state legislature each biennium.

Advantages/Disadvantages

Regulatory Authority

Advantages

DHES could continue in its current regulatory role. Installation of another branch of government would not be required for regulatory purposes.

Disadvantages

Increased manpower within DHES for administration of the program would be necessary. No power currently exists within DHES for rate regulation; therefore, no cap is set on the rates private waste management firms charge. This could lead to collusion between generators and waste management firms; generators could set fictitious rates for the purpose of obtaining grants, with later sharing of the surplus income with the waste management firm.

Education and Technical Assistance

Advantages

Some private firms are likely to have experience in a wide range of problems.

Disadvantages

DHES would have to continue this service, since private contractors may have little interest in generator education, and no regulation exists requiring this service be provided. Quality of

private-industry conducted education efforts cannot be guaranteed.

Costs and Financing

Advantages

No initial state facility funding is required for this option. Operation of the facility will benefit from free-market factors.

Disadvantages

Costs will have to include interest on all capital investments, since funding would be secured through private enterprise and lending institutions. This cost will be passed on to the generators. Guaranteed closure costs will also have to be provided by private industry for licensed transfer/storage facilities. Costs to generators cannot be guaranteed. Annual appropriations would be required for operation of the subsidy program. Substantial expense would be involved in administering the program; a reasonable fee would have to be determined and constantly revised, a potentially large number of applications would have to be reviewed, and safety measures involving fraud would have to be put in place. Encouragement for private sector waste management firms to operate as efficiently as possible would not exist.

Acceptance

Advantages

Some generators who have complied for some time with hazardous waste regulations may already have established relationships with private waste management firms. Arrangements with TSDFs may already exist.

Disadvantages

Public acceptance may be low, due to existing opinions on priorities of private firms. TSDF and transporter acceptance will depend on previous experience and track record of the private firm of interest. Siting of a facility by private industry is highly problematic, and is considered a large business risk due to its historical high rate of failure. Generators may turn to illegal disposal depending on turn-around time for grant monies.

Rate of Compliance

Advantages

Private waste management firms have compliance histories which can be checked and flagged for potential problems.

Disadvantages

Subsidies to generators do not guarantee that all generators will be serviced; such subsidies only enhance their economic attractiveness to private firms. Private industry could require larger and larger financial incentives to service these generators, resulting in a breakdown of services altogether due to the eventual inability of the State to finance such service. Compliance of a private storage/transfer operation with standards can be guaranteed only as much as enforcement capabilities exist. Incentive for waste minimization or recycling is substantially diminished.

Liability

Advantages

Liability of private waste management firms is well established.

Disadvantages

Potential liability from improper disposal will most probably be conveyed through market forces, a rather slow process. Private industry will be subject to all insurance requirements, which are difficult to fulfill.

Protection of Public health and the Environment

Advantages

Established firms in the waste management industry are experienced in the collection and handling of hazardous wastes.

Disadvantages

Illegal disposal by SQGs will be encouraged, due to the expected time lag between need for disposal and receival of the grant. Private industry is not mandated to protect human health and the environment.

Previous Experience

The existing waste management marketplace primarily consists of privately-owned/privately-operated facilities and services. The record of these operations is mixed; siting becomes increasingly difficult. Only a handful of hazardous waste facilities have been successfully sited in the past three years; of these, very few were sited by private industry. No subsidy program such as this is known to exist.

Summary

The options presented here represent the widest spectrum of solutions to SQG collection problems currently available. While all the options have a number of disadvantages and advantages, the importance or weight of each factor will differ according to the specific environment (regulatory, economic, institutional) in which SQG problems occur. The options are summarized with respect to the current environment in Montana below.

State-owned, State-operated

While this option presents the greatest amount of control over all aspects of hazardous waste management including guaranteed service to all generators, it involves a potentially major reworking of present DHES structure. Regulatory responsibilities of DHES may be compromised by the direct management of a facility. Competition with private industry for more profitable generators may increase overall costs. Also, the State has no previous experience in the operation of a hazardous waste facility. Difficulties of financing and obtaining financial assurance measures are greatly reduced.

While this option may provide the highest protection of public health and the environment, it involves major regulatory authority issues, and may serve to undermine the current public trust of DHES.

State-owned, Privately-operated

This option allows a point of control for DHES over the operations of a facility through use of the bid specification process, including guarantee of service to all generators that desire the service. DHES' current regulatory role would not have to be altered. Operation of the facility will benefit from free-market factors, as well as the State's exemption from financial assurance requirements. The operating relationship between DHES and the private contractor(s) needs to be well-defined, as well as measures to be taken if and when the contractor(s) fails to properly provide the contracted services. Cooperation between government and industry towards solution of the hazardous waste management problems would be greatly enhanced.

This option allows a mix of both public and private advantages; while a point of control is provided, and service is guaranteed, the operation will benefit from the experience of private operators and free-market factors. Public sector siting of a

facility will do much to attract hazardous waste management services.

Privately-owned, Privately-operated

DHES could continue in its current regulatory role; however, increased enforcement and inspection manpower would be necessary. While the operation would benefit from free-market factors, it is improbable that all generators in the state would be served. Potential liability from improper disposal would be conveyed through free-market forces, a rather slow process. Illegal disposal may be encouraged due to the expected high cost that will be presented to the smaller and more distant generators.

This option reflects the current status of hazardous waste management in the State. While the operation benefits from free-market forces, the density and geographical placement of SQGs in the State greatly increases the probability of endangerment of public health and the environment.

Privately-owned, Privately-operated System, With Subsidies To Contractors

DHES could continue in its current regulatory role, although manpower increases would be necessary for increased enforcement and inspection duties and the administrative burdens associated with this option. While all generators could be served, the required subsidy is expected to be large. Selection of private firms to subsidize, funding/spending oversight, subsidy review, etc., may require substantial administrative expenses.

This option, while potentially serving all generators, offers no potential point of control over the services and rates offered by the subsidized company. Appropriations required under these circumstances could be sizeable.

Privately-owned, Privately-operated Systems, With Generator Subsidies

While DHES could maintain its current regulatory role, no rate regulation mechanism exists. This could serve to precipitate an uncontrollable and un-policeable situation regarding rates charged. Substantial expense would be involved in administering the program, as well as difficulty in setting "reasonable" rates. The time lag between disposal needs and grant receival may encourage illegal disposal. Service to generators is not guaranteed.

This option contains excessive administrative burdens and poses a potential threat to public health and the environment.

Ranking of Options

The relative criteria for ranking the options for the various factors used in this analysis is presented in Table 6-1. The ranking is summarized in Table 6-2. As indicated in Table 6-2, the most desireable options are state-owned, privately-operated and state-owned, state-operated, respectively. The privately-owned, privately-operated options with and without subsidies are ranked substantially lower than the other two options.

TABLE 6-1

RELATIVE SCORING SYSTEM FOR POLICY OPTIONS

FACTOR	CHARACTERISTICS OF PERFORMANCE: Least Desirable	Most Desirable
Regulatory Authority	Requires extensive reordering of DHES for increased manpower	DHES can continue in current regulatory role
Education & Technical	Efforts not guaranteed	Efforts guaranteed
Cost and Financing	High initial and/or continuing cost to State or generators	Low initial and/or continuing cost to State or generators
Acceptance	Public generator acceptance of facility and service is low	Public generator acceptance of facility and service is high
Rate of Compliance	Generators are unaware or unmotivated to achieve compliance	Generators are encouraged to comply
Liability	Potential liability to generators conveyed through slow processes; financial assurance requirements difficult to obtain	Potential liability to generators clearly understood; financial assurance requirements obtainable
Protection of Public Health and the Environment	Endangers public health and the environment	Public health and the environment is protected to greatest extent possible

TABLE 6-2

RANKING OF ALTERNATE IMPLEMENTATION STRATEGIES

	Category & Rank							
Option	Regulatory Authority	Education and Technical Assistance	Costs and Financing	Acceptance	Rate of Compliance	Financial Assurance	Protection of Public Health and the Environ.	Total
State-Owned, State-Operated	1	3	1	3	3	3	3	17
State-Owned, Privately-Operated	3	2	3	3	3	2	3	19
Privately-Owned, Privately Operated	3	1	3	2	2	1	1	13
Privately-Owned, Privately Operated, With Subsidy To Contractors	1	2	1	2	2	1	2	11
Privately-Owned, Privately Operated With Subsidy To Generators	1	1	1	2	1	1	1	8

NOTE: Most desirable rating = 3 points, least desirable rating = 1 point.

SECTION 7

RECOMMENDATIONS

SECTION 7

RECOMMENDATIONS

The following recommendations are made for the type of storage/transfer system needed and the implementation strategy to be used:

Storage/Transfer System

In Section Four of this report, four basic technologies were evaluated for disposing of the hazardous wastes generated in Montana. These technologies included recovery systems, thermal destruction systems, land disposal facilities, and storage/transfer systems.

As indicated in Section Four, the consultant recommends that recovery, thermal destruction treatment, and land disposal facilities not be constructed in Montana. Elimination from further consideration of these three technologies is primarily due to economics. These types of facilities require a substantially higher volume of hazardous waste than what is currently generated in Montana to be considered economically viable options. Also, for the landfilling technology, there is a distinct possibility that the EPA will ban the use of landfilling for several types of hazardous wastes. Thus, this option cannot be considered a long-term solution for the disposal of hazardous wastes.

Based on the analysis summarized in Section Four, the consultant recommends the implementation of a collection, storage and transfer system to manage and dispose of the state's hazardous wastes. The consultant evaluated in detail two transfer/storage concepts: 1) construction of a strategically located transfer station in the state whereby all hazardous wastes delivered to the station would be stored until full truckloads of material could be accumulated and ultimately transported to licensed facilities located out of state, and 2) construction of five staging facilities located throughout the state whereby the wastes would be accumulated for a maximum of ten days and ultimately transported to out of state licensed facilities.

Based on the analysis summarized in Section Five, the consultant recommends that the central transfer station concept be implemented. Under this concept, the system would include a collection system whereby the hazardous wastes generated throughout the state would be collected on prearranged schedules

and transported to a transfer station using small van-type trucks. The transfer station would consist of a storage area for both drum and bulk storage. Once full truckloads of similar type wastes were accumulated, the waste would be loaded onto transfer trailers capable of hauling up to 80 drums. These wastes would then be transported to out of state disposal facilities.

The central transfer station option is recommended over the multiple staging facilities concept for the following reasons:

1) The system costs of the central facilities concept is approximately 13 to 23 percent less expensive than the staging area concept depending upon the volume of waste handled.

2) The transfer station would be a licensed facility which would allow wastes to be stored indefinitely, in contrast to the staging facilities that would not be licensed and would therefore have to transport wastes within 10 days after their delivery. This indefinite storage affords the following advantages:

    a) allows accumulation of full truckloads of similar type wastes which minimizes transportation costs,

    b) allows the manager of transfer system to broker the wastes which affords the best possible "drop charge" at the selected disposal site(s),

    c) allows for substantially more flexibility in the collection system since wastes can be stored for more than 10 days at the transfer facility,

    d) provides a safer system since the system would not have to handle "mixed" loads of materials. Also, this concept would be better suited to handle emergency loads, and

    e) increases flexibility in the collection, storage and transportation systems and encourages generator use compared to the 10-day staging facility concept.

Implementation Strategy

Operation/Management

As indicated in Section Six of this report, the consultant evaluated three basic management scenarios for implementing the collection/storage/transfer system. These included: 1) state owned state-operated, 2) state-owned privately operated, and 3) privately owned/privately operated. Based on the analysis presented in Section Six, it is recommended that the second scenario be implemented. This includes the State of Montana providing the necessary funds to site, design, and construct the strategically located transfer facility. Under this management strategy, the state would develop a bid document and specification to contract out the necessary vehicles, equipment, labor, etc. to manage and operate the waste collection system, transfer station, and transportation system for hauling the wastes from the transfer station to the final disposal site and would do the necessary work involved in negotiating and contracting with the various facilities to accept and dispose of the wastes. The primary reasons for selecting this management option include the following:

1) This option allows the DHES to maintain regulatory control of the hazardous waste management in the state. If the state were to operate the program, the regulatory authority would most likely have to be shifted to the EPA.

2) This option guarantees that all wastes generated in the state could be handled. If private enterprise were to implement the program, there would be no way to require that all generators be provided service. Lack of service would encourage illegal disposal by the small generators due to either lack of available service or extremely high costs.

3) This option allows the state to subsidize the program more directly at any time in the future if the legislature so desires.

4) This option will require the selected contractor(s) to provide public education in conjunction with their work. This education can be coordinated with the efforts of the DHES.

5) This option allows the DHES to maintain management and control of the hazardous waste handling practices in the state and at the same time allow private enterprise to provide the majority of the equipment and labor

required to collect and dispose of the state's hazardous wastes.

6) This option allows for a solid, long-lasting program for hazardous waste management. This should also provide for the best possibilities of obtaining liability insurance at the lowest possible rate.

Subsidies

In Section Six, the option of the legislature providing subsidies to either the individual generators or to contractors that provide hazardous waste management services was evaluated. This evaluation was conducted with the assumption that private enterprise would own and operate all facilities and equipment and provide the necessary services. Based on this analysis, the consultants do not recommend that subsidies be issued at this time to either contractors or the generators for the following reasons:

1) Current regulations do not provide any point of control over the services and rates offered by the companies.

2) Development of criteria for the selection of the companies or generators to subsidize would be difficult.

3) The distinct potential for collaboration between the contractors and generators exists. Oversight of this possibility could be expensive and difficult.

4) The general administrative expenses associated with a subsidy program would be high and would most likely require the addition of several DHES staff.

5) A subsidy program would still not guarantee service to all generators desiring service.

6) A subsidy program would require legislative approval every biennium. If approval of the subsides were not approved by a particular legislative session, the hazardous waste management program could be thrown into disarray and correspondingly encourage illegal dumping, etc.

7) The time lag between the need for disposal service and the receiving of subsidies may encourage illegal disposal.

Schedule of Tasks

The following general tasks should be initiated in order to implement the recommended plan:

1) The State should initiate the siting, permitting, and design functions associated with the development of a transfer/storage facility. These functions are estimated to take 12-18 months. Performance of these functions concommitant with selection of the operating firm(s) will allow their input into the facility design.

2) The state should prepare a bid specification document for the operation of the system as soon as possible. The document should include the technical specifications including labor, equipment, and other requirements for operating the collection system, transfer facility, transportation system for delivering the wastes to the final disposal facilities and the necessary negotiations, etc. for utilizing the licensed disposal sites. The document should also include the proposed fee schedule based on type of waste, distance to hauler, etc. The specifications should also delineate revenue collection procedures, testing costs, insurance requirements, and other general and specific conditions that will apply.

3) The State should advertise for bids for the operation of the system as soon as the bid document has been finalized. Once bids have been received and reviewed, contracts should be awarded to allow the successful bidder(s) sufficient time to hire and train personnel and receive delivery of equipment.

4) Once the facility has been designed, contracts should be advertised and awarded for construction. The State should retain qualified engineers and architects to inspect and monitor the construction.

Appendix A

Listed Hazardous Waste

WASTE CODES

WASTE #	WASTE NAME
D001	IGNITABLE WASTE
D002	CORROSIVE WASTE-MINERAL ACID
D002	CORROSIVE WASTE-ALKALINE
D003	REACTIVE WASTE SULFIDES
D003	REACTIVE WASTE CYANIDES
D004	ARSENIC
D005	BARIUM
D006	CADMIUM
D007	CHROMIUM
D008	LEAD
D009	MERCURY
D010	SELENIUM
D011	SILVER
D012	ENDRIN
D013	LINDANE
D014	METHOXYCHLOR
D015	TOXAPHENE
D016	2,4-D
D017	SILVEX
F001	SPENT HALOG. SOLVENTS USED IN DEGREASING
F002	SPENT HALOG. SOLVENTS AND STILL BOTTOMS
F003	SPENT NON HALOGENATED SOLVENTS AND STILL BOTTOMS
F004	SPENT NON HALOGENATED SOLVENTS AND STILL BOTTOMS
F005	SPENT NON HALOGENATED SOLVENTS AND STILL BOTTOMS
F006	WASTE WATER TREATMENT SLUDGE FROM ELECTROPLATING OPERATIONS
F007	SPENT CYANIDE PLATING BATH SOLUTIONS FROM ELECTROPLATING OPERATIONS INCL. PRECIOUS METALS OPS.
F008	PLATING BATH SLUDGE FROM THE BOTTOM OF PLATING BATHS FROM ELECTROPLATING INCL. PRECIOUS METALS OPS.
F009	SPENT STRIPPING AND CLEANING BATH SOLUTIONS FROM ELECTROPLATING OPER(CYANIDE) INCL. PRECIOUS METALS OPS.
F010	QUENCHING BATH SLUDGE FROM OIL BATHS FROM METAL AND PRECIOUS METAL HEAT TREAT. OP.(CYANIDE)
F011	SPENT CYANIDE SOLN. FROM SALT BATH POT CLEANING FROM METAL AND PRECIOUS METAL HEAT TREAT. OPER.
F012	WWT SLUDGE FROM METAL AND PRECIOUS METAL HEAT TREAT. OPER. (CYANIDES)
F019	WWT SLUDGE FROM CHEMICAL CONVERSION COATING OF ALUMINUM
F020	WASTES FROM PROD. OR MFG. USE OF TRI/TETRACHLOROPHENOL & INTERMEDIATES
F021	WASTES FROM PROD. OR MFG. USE OF PENTACHLOROPHENOL & INTERMEDIATES
F022	WASTES FROM PROD. OR MFG. USE OF TETRA/PENTA/HEXACHLOROBENZENES - ALLK. COND'S.
F023	WASTES FROM PROD. ON EQUIPT. USED IN PROD/MFG. USE OF TRI/TETRACHLOROPHENOLS
F026	WASTES FROM PROD. ON EQUIPT. USED IN MFG. USE OF TETRA/PENTA/HEXACHLOROBENZENE - ALK. COND'S.
F027	DISCARD PRODS. CONTAINING TRI/TETRA/PENTACHLOROPHENOL OR DERIVS.
F028	INCIN/RESIDUES - SOIL CONTAM. W/F020,21,23,26,AND 27 THERMAL TRT.
K001	BOTTOM SEDIMENT SLUDGE FROM TREAT. OF WASTE WATER FROM WOOD PRESERVING PROCESS
K002	WASTEWATER TREAT. SLUDGE FROM PRODUCTION OF CHROME YELLOW & ORANGE PIGMENTS
K003	WWT SLUDGE FROM THE PRODUCTION OF MOLYBDATE ORGANIC PIGMENTS
K004	WWT SLUDGE FROM THE PRODUCTION OF ZINC YELLOW PIGMENTS
K005	WWT SLUDGE FROM THE PRODUCTION OF CHROME GREEN PIGMENTS
K006	WWT SLUDGE FROM THE PRODUCTION OF CHROME OXIDE GREEN PIGMENTS
K007	WWT SLUDGE FROM THE PRODUCTION OF IRON BLUE PIGMENTS
K008	OVEN RESIDUE FROM THE PRODUCTION OF CHROME OXIDE GREEN PIGMENTS
K009	DISTILLATION BOTTOMS FROM THE PRODUCTION OF ACETALDEHYDE FROM ETHYLENE
K010	DISTILLATION SIDE CUTS FROM THE PRODUCTION OF ACETALDEHYDE FROM ETHYLENE
K011	BOTTOM STREAM FROM WW STRIPPER IN THE PRODUCTION OF ACRYLONITRILE
K013	BOTTOM STREAM FROM THE ACETONITRILE COLUMN IN THE PROD. OF ACRYLONITRILE
K014	BOTTOMS FROM THE ACETONITRILE PURIFICATION COLUMN IN THE PROD. OF ACRYLONITRILE

WASTE CODES

WASTE #	WASTE NAME
K015	STILL BOTTOMS FROM DISTILLATION OF BENZYL CHLORIDE
K016	HEAVY ENDS OR DISTILLATION RESIDUES FROM THE PRODUCTION OF CARBON TETRACHLORIDE
K017	STILL BOTTOMS FROM THE PURIFICATION COLUMN IN THE PRODUCTION OF EPICHLOROHYDRIN
K018	HEAVY END FROM FRACTIONATION IN ETHYL CHLORIDE PRODUCTION
K019	HEAVY ENDS FROM DISTILLATION OF DICHLORIDE IN ETHYLENE DICHLORIDE PRODUCTION
K020	HEAVY ENDS FROM THE DISTILLATION OF VINYL CHLORIDE IN VINYL CHLORIDE MONOMER PD.
K021	AQUEOUS SPENT ANTIMONY CATYLYST WASTE FROM FLUOROMETHANE PRODUCTION
K022	DISTILLATION BOTTOM TARS FROM THE PRODUCTION OF PHENOLS/ACETONE FROM CUMENE
K023	DISTILLATION LIGHT ENDS FROM THE PROD. OF PHTHALIC ANHYDRIDE FROM NAPHTHALENE
K024	DISTILLATION BOTTOMS FROM THE PROD. OF PHTHALIC ANHYDRIDE FROM NAPHTHALENE
K025	DISTILLATION BOTTOMS FROM THE PROD. OF NITROBENZENE BY THE NITRATION OF BENZENE
K026	STRIPPING STILL TAILS FROM THE PROD. 0F METHYL ETHYL PYRIDINES
K027	CENTRIFUGE AND DISTILLATION RESIDUE FROM TOLUENE DIISOCYANATE PRODUCTION
K028	SPENT CATYLYST FROM HYDROCHLORINATOR REACTOR IN THE PROD OF 1,1,1TRICHLOROETHANE
K029	WASTE FROM THE PRODUCT STREAM IN THE PROD OF 1,1,1-TRICHLOROETHANE
K030	COLUMN BOTTOMS FROM COMBINED PROD OF TRICHLOROETHYLENE AND PERCHLOROETHYLENE
K031	BY PRODUCT SALTS IN THE PRODUCTION OF MSMA AND CACODYLIC ACID
K032	WWT SLUDGE FROM THE PROD. OF CHLORDANE
K033	WW FROM THE CHLORINATION OF CYCLOPENTADIENE IN THE PROD. OF CHLORDANE
K034	FILTER SOLIDS HEXACHLOROCYCLOPENTADIENE IN THE PROD. OF CHLORDANE
K035	WWT SLUDGES GENERATED IN THE PRODUCTION OF CREOSOTE
K036	STILL BOTTOMS FROM TOLUENE RECLAMATION DISTILLATION IN THE PROD OF DISULFOTON
K037	WWT SLUDGE FROM THE PRODUCTION OF DISULFOTON
K038	WW FROM THE WASHING AND STRIPPING OF PHORATE PRODUCTION
K039	FILTER CAKE FROM DIETHYLPHOSPHORODITHIOIC ACID IN THE PROD OF PHORATE
K040	WWT SLUDGE FROM THE PRODUCTION OF PHORATE
K041	WWT SLUDGE FROM THE PRODUCTION OF TOXAPHENE
K042	HEAVY ENDS FROM THE DISTILLATION OF TETRACHLOROBENZENE IN THE PROD OF 2,4,5-T
K043	2,6-DICHLOROPHENOL WASTE FROM THE PRODUCTION OF 2,4-D
K046	WWT SLUDGE FROM THE MANUF.,FORMULATION,LOADING OF LEADBASED INITIATING COMPOUNDS
K047	PINK/RED WATER FROM TNT OPERATIONS
K048	DAF FLOAT FROM THE PETROLEUM REFINING INDUSTRY
K049	SLOP OIL SOLIDS FROM THE PETROLEUM REFINING INDUSTRY
K050	HEAT EXCHANGER BUNDLE CLEANING SLUDGE FROM THE PETROLEUM REFINING INDUSTRY
K051	API SEPARATOR SLUDGE FROM THE PETROLEUM REFINING INDUSTRY
K052	TANK BOTTOMS(LEADED) FROM THE PETROLEUM REFINING INDUSTRY
K060	AMMONIA STILL LIME SLUDGE FROM COKING OPERATIONS
K062	SPENT PICKLE LIQUOR FROM STEEL FINISHING OPERATIONS
K069	EMISSION CONTROL DUST/SLUDGE FROM SECONDARY LEAD SMELTING
K071	BRINE PURIFICATION MUDS FROM THE MERCURY CELL PROCESS IN CHLORINE PRODUCTION
K073	CHLORINATED H.C. WASTE FROM THE PURIFICATION STEP IN CHLORINE PROD.
K083	DISTILLATION BOTTOMS FROM ANILINE PRODUCTION
K084	WWT SLUDGES GENERATED FROM VETERINARY PHARMACEUTICALS FROM ARSENIC COMPOUNDS
K085	DISTILLATION OR FRACTIONATION COLUMN BOTTOMS FROM THE PROD. OF CHLOROBENZENE
K086	SOLV. WASHES AND SLUDGES,CAUSTIC WASHES,WATER WASHES FROM CLEANING TUBS-INK IND.
K087	DECANTER TANK TAR SLUDGE FROM COKING OPERATIONS
K093	DISTILLATION LIGHT ENDS FROM THE PROD. OF PHTHALIC ANHYDRIDE FROM ORTHO-XYLENE
K094	DISTILLIATON BOTTOMS FROM THE PROD. OF PHTHALIC ANHYDRIDE FROM ORTHO-XYLENE
K095	DISTILLATION BOTTOMS FROM THE PROD. OF 1,1,1-TRICHLOROETHANE
K096	HEAVY ENDS FROM THE HEAVY ENDS COLUMNS FROM THE PROD OF 1,1,1-TRICHLOROETHANE
K097	VAC. STRIPPER DISCHARGE FROM THE CHLORDANE CHLORINATOR IN THE PROD OFCHLORDANE
K098	UNTREATED PROCESS WW FROM THE PRODUCTION OF TOXAPHENE

WASTE #	WASTE NAME
K099	UNTREATED WW FROM THE PRODUCTION OF 2,4-D
K100	WASTE LEACHING SOLN FROM EMISSION CONTROL DUST/SLDG:FROM SECONDARY LEAD SMELTING
K101	DISTILLATION TAR COMPOUNDS FROM THE DISTILLATION OF ANILINE-BASED COMPOUNDS
K102	RESIDUE FROM THE USE OF ACT. CARBON FOR DECOLORIZATION (VET PHARMACEUT)
K103	PROCESS RESIDUES FROM ANILINE EXTRACTION FROM THE PROD. OF ANILINE
K104	COMBINED WW STREAMS GENERATED FROM NITROBENZENE/ANILINE PRODUCTION
K105	SEPARATED AQUEOUS STREAM FROM THE WASHING STEP IN THE PROD. OF CHLOROBENZENES
K106	WWT SLUDGE FROM THE MERCURY CELL PROCESS IN CHLORINE PRODUCTION
K111	DINITROTOLUENE PRODN. WASHWATERS(VIA TOLUENE NITRATION)
K112	RXN. BYPRODUCT WATER - PRODN. OF TOLUENEDIAMINE
K113	CONDENSED LT. ENDS FROM PURIF. OF TOLUENEDIAMINE
K114	VICINALS FROM PURIF. OF TOLUENEDIAMINE
K115	HEAVY ENDS FROM PURIF. OF TOLUENEDIAMINE
K116	ORG. COND. FROM SOLVENT RECOVERY IN PROD. OF TOLUENE DIISOCYANTE
K117	REACTOR VENT GAS SCRUBBER WW IN PROD. OF ETHYLENE DIBROMINE
K118	SPENT ADSORBENT SOLIDS - PURIF. OF ETHYLENE DIBROMIDE
K136	STILL BOTTOMS FROM PURIF OF ETHYLENE DIBROMIDE
P001	3-(ALPHA-ACETONYLBENZYL)-4-HYDROXYCOUMARIN AND SALTS
P001	WARFARIN
P002	ACETAMIDE, N-(AMINOTHIOXOMETHYL)-
P002	1-ACETYL-2-THIOUREA
P003	ACROLEIN
P003	2-PROPENAL
P004	ALDRIN
P004	****SEE REGS****
P005	ALLYL ALCOHOL
P005	2-PROPEN-1-OL
P006	ALUMINUM PHOSPHIDE(R,T)
P007	5-(AMINOMETHYL)3-ISOXAZOLOL
P007	3(2H)-ISOXAZOLONE,5-(AMINOMETHYL)-
P008	4-AMINOPYRIDINE
P008	4-PYRIDINAMINE
P009	AMMONIUM PICRATE (R)
P009	PHENOL,2,4,6-TRINITRO-,AMMOMIUM SALT (R)
P010	ARSENIC ACID
P011	ARSENIC(V)OXIDE
P011	ARSENIC PENTOXIDE
P012	ARSENIC(III)OXIDE
P012	ARSENIC TRIOXIDE
P013	BARIUM CYANIDE
P014	BENZENETHIOL
P014	THIOPHENOL
P015	BERYLLIUM DUST
P016	BIS(CHLOROMETHYL)ETHER
P016	METHANE,OXYBIS(CHLORO-)
P017	BROMOACETONE
P017	2-PROPANONE,1-BROMO-
P018	BRUCINE
P018	STRYCHNIDIN-10-ONE,2,3-DIMETHOXY-
P020	DINOSEB
P020	PHENOL,2,4-DINITRO-6(1-METHYLPROPYL)-
P021	CALCIUM CYANIDE

WASTE #	WASTE NAME
P022	CARBON BISULFIDE
P022	CARBON DISULFIDE
P023	ACETALDEHYDE,CHLORO-
P023	CHLOROACETALDEHYDE
P024	BENZENAMINE,4-CHLORO-
P024	P-CHLOROANILINE
P026	1-(O-CHLOROPHENYL)THIOUREA
P026	THIOUREA,(2-CHLOROPHENYL)-
P027	3-CHLOROPROPIONITRILE
P027	PROPANENITRILE,3-CHLORO-
P028	BENZENE,(CHLOROMETHYL)-
P028	BENZYL CHLORIDE
P029	COPPER CYANIDES
P030	CYANIDE (SOLUBLE SALTS),NOT ELSEWHERE SPECIFIED
P031	CYANOGEN
P033	CHLORINE CYANIDE
P033	CYANOGEN CHLORIDE
P034	4,6-DINITROL-O-CYCLOHEXYLPHENOL
P034	PHENOL,2-CYCLOHEXYL-4,6-DINITRO-
P036	DICHLOROPHENYLARSINE
P036	PHENYL DICHLOROARSINE
P037	DIELDRIN
P037	****SEE REGS****
P038	ARSENIC,DIETHYL-
P038	DIETHYLARSINE
P039	O,O-DIETHYL S-[2-(ETHYLTHIO)ETHYL] PHOSPHORO-DITHIOATE
P039	DISULFOTON
P040	O,O-DIETHYL O-PYRAZINYL PHOSPHOROTHIOATE
P040	PHOSPHOROTHIOIC ACID,O,O-DIETHYL O-PYRAZINYL ESTER
P041	DIETHYL-P-NITROPHENYL PHOSPHATE
P041	PHOSPHORIC ACID, DIETHYL P-NITROPHENYL ESTER
P042	1,2-BENZENEDIOL,4-[1-HYDROXY-2-(METHYLAMINO)ETHYL]-
P042	EPINEPHRINE
P043	DIISOPROPYL FLUOROPHOSPHATE
P043	PHOSPHOROFLUORIDIC ACID, BIS(1-METHYLETHYL)ESTER
P044	DIMETHOATE
P044	PHOSPHORODITHIOIC ACID,O,O-DIMETHYL S-[2-METHYLAMINO-2-OXOETHYL]ESTER
P045	3,3-DIMETHYL-1-(METHYLTHIO)-2-BUTANONE,O-[(METHYL-AMINO)CARBONYL]OXIME
P045	THIOFANOX
P046	ALPHA,ALPHA-DIMETHYLPHENETHYLAMINE
P046	ETHANAMINE,1,1-DIMETHYL-2-PHENYL-
P047	4,6-DINITRO-O-CRESOL AND SALTS
P047	PHENOL,2,4-DINITRO-6-METHYL-,AND SALTS
P048	2,4-DINITROPHENOL
P048	PHENOL,2,4-DINITRO-
P049	2,4-DITHIOBIURET
P049	THIOIMIDODICARBONIC DIAMIDE
P050	ENDOSULFAN
P050	5-NORBORNENE-2,3-DIMETHANOL,1,4,5,6,7,7-HEXACHLORO,CYCLIC SULFITE
P051	ENDRIN
P051	****SEE REGS****
P054	AZIRIDINE

WASTE CODES

WASTE #	WASTE NAME
P054	ETHYLENIMENE
P056	FLUORINE
P057	ACETAMIDE,2-FLUORO-
P057	FLUOROACETAMIDE
P058	ACETIC ACID,FLUORO-,SODIUM SALT
P058	FLUOROACETIC ACID, SODIUM SALT
P059	HEPTACHLOR
P059	4,7-METHANO-1H-INDENE,1,4,5,6,7,8,8-HEPTACHLORO-3A,4,7,7A-TETRAHYDRO-
P060	****SEE REGS****
P060	HEXACHLOROHEXAHYDRO-ENDO,ENDO-DIMETHANONAPHTHALENE
P062	HEXAETHYL TETRAPHOSPHATE
P062	TETRAPHOSPHORIC ACID,HEXAETHYL ESTER
P063	HYDROCYANIC ACID
P063	HYDROGEN CYANIDE
P064	ISOCYANIC ACID,METHYL ESTER
P064	METHYL ISOCYANATE
P065	FULMINIC ACID,MERCURY(II)SALT(R,T)
P065	MERCURY FULMINATE(R,T)
P066	ACETIMIDIC ACID,N-[(METHYL CARBAMOYL)OXY]THIO-,METHYL ESTER
P066	METHOMYL
P067	2-METHYLAZIRIDINE
P067	1,2-PROPYLENIMINE
P068	HYDRAZINE,METHYL-
P068	METHYL HYDRAZINE
P069	2-METHYLLACTONITRILE
P069	PROPANENITRILE,2-HYDROXY-2-METHYL-
P070	ALDICARB
P070	PROPANAL,2-METHYL-2-(METHYLTHIO)-,O[(METHYLAMINO)CARBONYL]OXIME
P071	0,0 DIMETHYL 0-P-NITROPHENYL PHOSPHOROTHIOATE
P071	METHYL PARATHION
P072	ALPHA-NAPHTHYLTHIOUREA
P072	THIOUREA,1-NAPHTHALENYL-
P073	NICKEL CARBONYL
P073	NICKEL TETRACARBONYL
P074	NICKEL CYANIDE
P074	NICKEL(II)CYANIDE
P075	NICOTINE AND SALTS
P075	PYRIDINE,(S)-3-(1-METHYL-2-PYRROLIDINYL)-,AND SALTS
P077	BENZENAMINE,4-NITRO-
P077	P-NITROANILINE
P078	NITROGEN DIOXIDE
P078	NITROGEN(IV) OXIDE
P082	DIMETHYLNITROSAMINE
P082	N-NITROSODIMETHYLAMINE
P084	ETHENAMINE,N-METHYL-N-NITROSO-
P084	N-NITROSOMETHYLVINYLAMINE
P085	DIPHOSPHORORAMIDE,OCTAMETHYL-
P085	OCTAMETHYLPYROPHOSPHORAMIDE
P087	OSMIUM OXIDE
P087	OSMIUM TETROXIDE
P088	ENDOTHALL
P088	7-OXABICYCLO[2.2.1]HEPTANE-2,3- DICARBOXYLIC ACID

WASTE #	WASTE NAME
P089	PARATHION
P089	PHOSPHOROTHIOIC ACID, 0,0-DIETHYL 0(P-NITRIPHENYL)ESTER
P092	MERCURY, (ACETATO-0)PHENYL-
P092	PHENYLMERCURIC ACETATE
P093	N-PHENYLTHIOUREA
P093	THIOUREA, PHENYL-
P094	PHORATE
P094	PHOSPHOROTHIOIC ACID, 0,0-DIETHYL S-(ETHYLTHIO)METHYL ESTER
P095	CARBONYL CHLORIDE
P095	PHOSGENE
P096	HYDROGEN PHOSPHIDE
P096	PHOSPHINE
P097	FAMPHUR
P097	PHOSPHOROTHIOIC ACID 0,0-DIMETHYL 0-[P(DIMETHYLAMINO)-SULFONYL]PHENYL]ESTER
P098	POTASSIUM CYANIDE
P099	POTASSIUM SILVER CYANIDE
P101	ETHYL CYANIDE
P101	PROPANENITRILE
P102	PROPARGYL ALCOHOL
P102	2-PROPYN-1-OL
P103	CARBAMIMIDOSELENOIC ACID
P103	SELENOUREA
P104	SILVER CYANIDE
P105	SODIUM AZIDE
P106	SODIUM CYANIDE
P107	STRONTIUM SULFIDE
P108	STRYCHNIDIN-10-ONE, AND SALTS
P108	STRYCHNINE AND SALTS
P109	DITHIOPYROPHOSPHORIC ACID, TETRAETHYL ESTER
P109	TETRAETHYLDITHIOPYROPHOSPHATE
P110	PLUMBANE, TETRAETHYL
P110	TETRAETHYL LEAD
P111	PYROPHOSPHORIC ACID, TETRAETHYL ESTER
P111	TETRAETHYLPYROPHOSPHATE
P113	THALLIC OXIDE
P113	THALLIUM(III) OXIDE
P114	THALLIUM(I) SELENIDE
P115	SULFURIC ACID, THALLIUM(I)SALT
P115	THALLIUIM(I) SULFATE
P116	HYDRAZINECARBOTHIOAMIDE
P116	THIOSEMICARBAZIDE
P118	METHANETHIOL, TRICHLORO-
P118	TRICHLOROMETHANETHIOL
P119	AMMONIUM VANADATE
P119	VANADIC ACID, AMMONIUM SALT
P120	VANADIUM PENTOXIDE
P120	VANADIUM(V)OXIDE
P121	ZINC CYANIDE
P122	ZINC PHOSPHIDE(R,T)
P123	CAMPHENE, OCTACHLORO-
P123	TOXAPHENE
U001	ACETALDEHYDE(I)

WASTE CODES

WASTE #	WASTE NAME
U001	ETHANAL(I)
U002	ACETONE(I)
U002	2-PROPANONE(I)
U003	ACETONITRILE (I,T)
U003	ETHANENITRILE(I,T)
U004	ACETOPHENONE
U004	ETHANONE,1-PHENYL-
U005	ACETAMIDE,N-9H-FLUOREN-2-YL-
U005	2-ACETYLAMINOFLUORENE
U006	ACETYL CHLORIDE(C,R,T)
U006	ETHANOYL CHLORIDE(C,R,T,)
U007	ACRYLAMIDE
U007	2-PROPENAMIDE
U008	ACRYLIC ACID(I)
U008	2-PROPENOIC ACID(I)
U009	ACRYLONITRILE
U009	2-PROPENENITRILE
U010	***SEE REGS***
U010	MITOMYCIN C
U011	AMITROLE
U011	1H-1,2,4-TRIAZOL-3-AMINE
U012	ANILINE(I,T)
U012	BENZENAMINE(I,T)
U014	AURAMINE
U014	BENZENAMINE,4,4'-CARBONIMIDOYLBIS(N,N-DIMETHYL-
U015	AZASERINE
U015	L-SERINE,DIAZOACETATE(ESTER)
U016	BENZ(C)ACRIDINE
U016	3,4-BENZACRIDINE
U017	BENZAL CHLORIDE
U017	BENZENE,(DICHLOROMETHYL)-
U018	BENZ(A)ANTHRACENE
U018	1,2-BENZANTHRACENE
U019	BENZENE(I,T)
U020	BENZENESULFONIC ACID CHLORIDE (C,R)
U020	BENZENESULFONYL CHLORIDE (C,R)
U021	BENZIDINE
U021	(1,1'-BIPHENYL)-4,4'-DIAMINE
U022	BENZO(A)PYRENE
U022	3,4-BENZOPYRENE
U023	BENZENE,(TRICHLOROMETHYL)-(C,R,T,)
U023	BENZOTRICHLORIDE (C,R,T)
U024	BIS(2-CHLOROETHOXY)METHANE
U024	ETHANE,1,1'-[METHYLENEBIS(OXY)]BIS[2-CHLORO-
U025	DICHLOROETHYL ETHER
U025	ETHANE,1,1'OXYBIS[2-CHLORO-
U026	CHLORNAPHAZINE
U026	2-NAPHTHYLAMINE,N,N-BIS(2-CHLOROETHYL)-
U027	BIS(2-CHLOROISOPROPYL)ETHER
U027	PROPANE,2,2'OXYBIS(CHLORO-
U028	1,2-BENZENEDICARBOXYLIC ACID,[BIS(2-ETHYL-HEXYL)]ESTER
U028	BIS(2-ETHYLHEXYL)PHTHALATE

WASTE #	WASTE NAME
U029	METHANE, BROMO-
U029	METHYL BROMIDE
U030	BENZENE, 1-BROMO-4-PHENOXY-
U030	4-BROMOPHENYL PHENYL ETHER
U031	1-BUTANOL(I)
U031	N-BUTYL ALCOHOL(I)
U032	CALCIUM CHROMATE
U032	CHROMIC ACID, CALCIUM SALT
U033	CARBON OXYFLUORIDE(R, T)
U033	CARBONYL FLUORIDE(R, T)
U034	ACETALDEHYDE, TRICHLORO-
U034	CHLORAL
U035	BUTANOIC ACID, 4-[BIS(2-CHLOROETHYL)AMINO]BENZENE-
U035	CHLORAMBUCIL
U036	CHLORDANE, TECHNICAL
U036	4, 7-METHANOINDAN, 1, 2, 4, 5, 6, 7, 8, 8-OCTACHLORO 3A, 4, 7, 7A-TETRAHYDRO-
U037	BENZENE, CHLORO-
U037	CHLOROBENZENE
U038	BENZENEACETIC ACID, 4-CHLORO-ALPHA-(4-CHLOROPHENYL)-ALPHA-HYDROXY, ETHYL ESTER
U038	ETHYL 4, 4'-DICHLOROBENZILATE
U039	4-CHLORO-M-CRESOL
U039	PHENOL, 4-CHLORO-3-METHYL-
U041	1-CHLORO-2, 3-EPOXYPROPANE
U041	OXIRANE, 2-(CHLOROMETHYL)-
U042	2-CHLOROETHYL VINYL ETHER
U042	ETHENE, 2-CHLOROETHOXY-
U043	ETHANE, CHLORO-
U043	VINYL CHLORIDE
U044	CHLOROFORM
U044	METHANE, TRICHLORO-
U045	METHANE ,CHLORO(I, T)
U045	METHYL CHLORIDE (I, T)
U046	CHLOROMETHYL METHYL ETHER
U046	METHANE, CHLOROMETHOXY-
U047	BETA-CHLORONAPHTALENE
U047	NAPTHALENE, 2-CHLORO-
U048	O-CHLOROPHENOL
U048	PHENOL, 2-CHLORO
U049	4-CHLORO-O-TOLUIDINE, HYDROCHLORIDE
U050	1, 2-BENZPHENANTHRENE
U050	CHRYSENE
U051	CREOSOTE
U052	CRESOLS
U052	CRESYLIC ACID
U053	2-BUTENAL
U053	CROTONALDEHYDE
U055	BENZENE, (1-METHYLETHYL)(I)
U055	CUMENE(I)
U056	BENZENE, HEXAHYDRO-(I)
U056	CYCLOHEXANE(I)
U057	CYCLOHEXANONE(I)
U058	CYCLOPHOSPHAMIDE

WASTE #	WASTE NAME
U058	2H-1,3,2-OXAZAPHOSPHORINE,2[BIS(2-CHLOROETHYL)AMINO]TETRAHYDRO-,2-OXIDE
U059	DAUNOMYCIN
U059	***SEE REGS***
U060	DDD
U060	DICHLORO DIPHENYL DICHLOROETHANE
U061	DDT
U061	DICHLORO DIPHENYL TRICHLOROETHANE
U062	DIALLATE
U062	S-(2,3-DICHLOROALLY)DIISOPROPYLTHIOCARBAMATE
U063	DIBENZ (A,H)ANTHRACENE
U063	1,2:5,6-DIBENZANTHRACRENE
U064	1,2:7,8-DIBENZOPYRENE
U064	DIBENZ(A,I)PYRENE
U066	1,2-DIBROMO-3-CHLOROPROPANE
U066	PROPANE,1,2-DIBROMO-3-CHLORO-
U067	ETHANE,1,2-DIBROMO-
U067	ETHYLENE DIBROMIDE
U068	METHANE,DIBROMO-
U068	METHYLENE BROMIDE
U069	1,2-BENZENEDICARBOXYLIC ACID, DIBUTYL ESTER
U069	DIBUTYL PHTHALATE
U070	BENZENE, 1,2-DICHLORO-
U070	O-DICHLOROBENZENE
U071	BENZENE,1,3-DICHLORO-
U071	M-DICHLOROBENZENE
U072	BENZENE,1,4-DICHLORO-
U072	P-DICHLOROBENZENE
U073	(1,1'- BIPHENYL)-4,4'-DIAMINE,3,3'-DICHLORO-
U073	3,3'-DICHLOROBENZIDINE
U074	2-BUTENE,1,4-DICHLORO-(I,T)
U074	1,4-DICHLORO-2-BUTENE(I,T)
U075	DICHLORODIFLUOROMETHANE
U075	METHANE,DICHLORODIFLUORO-
U076	ETHANE,1,1-DICHLORO-
U076	ETHYLIDENE DICHLORIDE
U077	ETHANE,1,2-DICHLORO-
U077	ETHYLENE DICHLORIDE
U078	1,1-DICHLOROETHYLENE
U078	ETHENE,1,1-DICHLORO-
U079	1,2-DICHLOROETHYLENE
U079	ETHENE,TRANS-1,1-DICHLORO-
U080	METHANE,DICHLORO-
U080	METHYLENE CHLORIDE
U081	2,4-DICHLOROPHENOL
U081	PHENOL,2,4-DICHLORO-
U082	2,6-DICHLOROPHENOL
U082	PHENOL,2,6-DICHLORO-
U083	1,2-DICHLOROPROPANE
U083	PROPYLENE DICHLORIDE
U084	1,3-DICHLOROPROPENE
U084	PROPENE,1,3-DICHLORO-
U085	2,2'-BIOXIRANE(I,T)

WASTE #	WASTE NAME
U085	1,2:3,4-DIEPOYBUTANE (I,T)
U086	N,N-DIETHYLHYDRAZINE
U086	HYDRAZINE,1,2-DIETHYL-
U087	0,0- DIETHYL-S-METHYL-DITHIOSPHOSPHATE
U087	PHOSPHORODITHIOIC ACID,0,0-DIETHYL S-METHYL ESTER
U088	1,2-BENZENECARBOXYLIC ACID,DIETHYL ESTER
U088	DIETHYL PHTHALATE
U089	DIETHYLSTILBESTROL
U089	4,4'- STILBENEDIOL,ALPHA,ALPHA'-DIETHYL-
U090	BENZENE,1,2-METHYLENEDIOXY-4-PROPYL-
U090	DIHYDROSAFROLE
U091	(1,1'BIPHENYL)-4,4'DIAMINE,3,3'-DIMETHYLOXY-
U091	3,3'-DIMETHOXYBENZIDINE
U092	DIMETHYLAMINE(I)
U092	METHANAMINE,N-METHYL-(I)
U093	BENZENAMINE,N,N-DIMETHYL-4-(PHENYLAZO)-
U093	DIMETHYLAMINOAZOBENZENE
U094	1,2-BENZANTHRACENE,7,12-DIMETHYL-
U094	7,12-DIMETHYLBENZ(A)ANTHRACENE
U095	(1,1'-BIPHENYL)-4,4'DIAMINE,3,3'-DIMETHYL-
U095	3,3'-DIMETHYLBENZIDENE
U096	ALPHA,ALPHA-DIMETHYLBENZYLHYDROPEROXIDE(R)
U096	HYDROPEROXIDE,1-METHYL-1-PHENYLETHYL-(R)
U097	CARBAMOYL CHLORIDE, DIMETHYL-
U097	DIMETHYLCARBAMOYL CHLORIDE
U098	1,1-DIMETHYLHYDRAZINE
U098	HYDRAZINE,1,1-DIMETHYL-
U099	1,2-DIMETHYLHYDRAZINE
U099	HYDRAZINE,1,2-DIMETHYL-
U101	2,4-DIMETHYYLPHENOL
U101	PHENOL,2,4-DIMETHYL-
U102	1,2-BENZENEDICARBOXYLIC ACID,DIMETHYL ESTER
U102	DIMETHYL PHTHALATE
U103	DIMETHYL SULFATE
U103	SULFURIC ACID,DIMETHYL ESTER
U105	BENZENE,1-METHYL-2,4-DINITRO-
U105	2,4-DINITROTOLUENE
U106	BENZENE,1-METHYL-2,6-DINITRO-
U106	2,6-DINITROTOLUENE
U107	1,2-BENZENEDICARBOXYLIC ACID,DI-N-OCTYL ESTER
U107	DI-N-OCTYL PHTHALATE
U108	1,4-DIETHYLENE DIOXIDE
U108	1,4-DIOXANE
U109	1,2-DIPHENYLHYDRAZINE
U109	HYDRAZINE,1,2-DIPHENYL-
U110	DIPROPYLAMINE(I)
U110	1-PROPANAMINE,N-PROPYL-(I)
U111	DI-N-PROPYLNITROSAMINE
U111	N-NITROSODI-N-PROPYLAMINE
U112	ACETIC ACID,ETHYL ESTER(I)
U112	ETHYL ACETATE(I)
U113	ETHYL ACRYLATE(I)

WASTE #	WASTE NAME
U113	2-PROPENOIC ACID, ETHYL ESTER(I)
U114	1,2-ETHANEDIYLBISCARBAMODITHOIC ACID
U114	ETHYLENEBIS(DITHIOCARBAMIC ACID)SALTS AND ESTERS
U115	ETHYLENE OXIDE(I,T)
U115	OXIRANE(I,T)
U116	ETHYL THIOUREA
U116	2-IMIDAZOLIDINETHIONE
U117	ETHANE,1,1'-OXYBIS'(I)
U117	ETHYL ETHER(I)
U118	ETHYL METHACRYLAIE
U118	2-PROPENOIC ACID,2-METHYL-,ETHYL ESTER
U119	ETHYL METHANESULFONATE
U119	METHANESULFONIC ACID, ETHYL ESTER
U120	BENZO(J,K)FLUORENE
U120	FLUORANTHENE
U121	METHANE,TRICHLOROFLUORO-
U121	TRICHLOROMONOFLUOROMETHANE
U122	FORMALDEHYDE
U122	METHYLENE OXIDE
U123	FORMIC ACID(C,T)
U123	METHANOIC ACID(C,T)
U124	FURAN(I)
U124	FURFURAN(I)
U125	2-FURANCARBOXALDEHYDE(I)
U125	FURURAL(I)
U126	GLYCIDYLALDEHYDE
U126	1-PROPANOL,2,3-EPOXY-
U127	BENZENE, HEXACHLORO-
U127	HEXACHLOROBENZENE
U128	1,3-BUTADIENE,1,1,2,3,4,4-HEXACHLORO-
U128	HEXACHLOROBUTADIENE
U129	HEXACHLOROCYCLOHEXANE(GAMMA ISOMER)
U129	LINDANE
U130	1,3-CYCLOPENTADIENE,1,2,3,4,5,5-HEXACHLORO-
U130	HEXACHLOROCYCLOPENTADIENE
U131	ETHANE,1,1,1,2,2,2-HEXACHLORO-
U131	HEXACHLOROETHANE
U132	HEXACHLOROPHENE
U132	2,2'-METHYLENEBIS (3,4,6-TRICHLOROPHENOL)
U133	DIAMINE(R,T)
U133	HYDRAZINE(R,T)
U134	HYDROFLUORIC ACID(C,T)
U134	HYDROGEN FLUORIDE(C,T)
U135	HYDROGEN SULFIDE
U135	SULFUR HYDRIDE
U136	CACODYLIC ACID
U136	HYDROXYDIMETHYLARSINE OXIDE
U137	INDENO(1,2,3-CD)PYRENE
U137	1,10-(1,2-PHENYLENE)PYRENE
U138	METHANE,IODO-
U138	METHYL IODIDE
U139	FERRIC DEXTRAN

WASTE #	WASTE NAME
U139	IRON DEXTRAN
U140	ISOBUTYL ALCOHOL(I,T)
U140	1-PROPANOL,2-METHYL-(I,T)
U141	BENZENE,1,2-METHYLENEDIOXY-4-PROPENYL-
U141	ISOSAFROLE
U142	DECACHLOROOCTAHYDRO -1,3,4-METHENO-2H-CYCLOBUTA(C,D)- PENTALEN-2-ONE
U142	KEPONE
U143	LASIOCARPINE
U144	ACETIC ACID, LEAD SALT
U144	LEAD ACETATE
U145	LEAD PHOSPHATE
U145	PHOSPHORIC ACID,LEAD SALT
U146	LEAD SUBACETATE
U147	2,5-FURANDIONE
U147	MALEIC ANHYDRIDE
U148	1,2-DIHYDRO-3,6- PYRIDIZINEDIONE
U148	MALEIC HYDRAZIDE
U149	MALONONITRILE
U149	PROPANEDINITRILE
U150	ALANINE,3-[P-BIS(2-CHLOROETHYL)AMINO PHENYL-,L-
U150	MELPHALAN
U151	MERCURY
U152	METHACRYLONITRILE(T)
U152	2-PROPENENITRILE,2-METHYL-(I,T)
U153	METHANETHIOL(I,T)
U153	THIOMETHANOL
U154	METHANOL(I)
U154	METHYL ALCHOL(I)
U155	METHAPYRILENE
U155	PYRIDINE,2[(2-DIMETHYLAMINO)ETHYL]-2-THENYLAMINO-
U156	CARBONOCHLORIDIC ACID, METHYL ESTER(I,T)
U156	METHYL CHLOROCARBONATE(I,T)
U157	BENZ(J)ACEANTHRYLENE, 1,2-DIHYDRO-3-METHYL-
U157	3-METHYLCHOLANTHRENE
U158	BENZAMINE,4,4-METHYLENEBIS(2-CHLORO-
U158	4,4'-METHYLENEBIS(2-CHLOROANILINE)
U159	2-BUTANONE(I,T)
U159	METHYL ETHYL KETONE(I,T)
U160	2-BUTANONE PEROXIDE(R,T)
U160	METHYL ETHYL KETONE PEROXIDE(R,T)
U161	METHYL ISOBUTYL KETONE(I)
U161	4-METHYL-2-PENTANONE(I)
U162	METHYL METHACRYLATE(I,T)
U162	PROPENOIC ACID,2-METHYL-,METHYL ESTER(I,T)
U163	GUANIDINE,N-NITROSO-N-METHYL-N'-NITRO-
U163	N-METHYL-N'-NITRO-N-NITROSOGUANIDINE
U164	METHYLTHIOURACIL
U164	4(1H)-PYRIMIDINONE,2,3-DIHYDRO-6-METHYL-2-THIOXO-
U165	NAPHTHALENE
U166	1,3-NAPTHALENEDIONE
U166	1,4-NAPHTHOQUINONE
U167	1-NAPHTHYLAMINE

WASTE #	WASTE NAME
U167	ALPHA-NAPHTHYLAMINE
U168	2-NAPHTHYLAMINE
U168	BETA-NAPHTHYLAMINE
U169	BENZENE,NITRO-(I,T)
U169	NITROBENZENE(I,T)
U170	P-NITROPHENOL
U170	PHENOL,4-NITRO-
U171	2-NITROPROPANE(I)
U171	PROPANE,2-NITRO-(I)
U172	1-BUTANAMINE,N-BUTYL-N-NITROSO-
U172	N-NITROSODI-N-BUTYLAMINE
U173	ETHANOL,2,2'-(NITROSOIMINO)BIS-
U173	N-NITROSODIETHANOLAMINE
U174	ETHANAMINE,N-ETHYL-N-NITROSO-
U174	N-NITROSODIETHYLAMINE
U176	CARBAMIDE,N-ETHYL-N-NITROSO-
U176	N-NITROSO-N-ETHYLUREA
U177	CARBAMIDE,N-METHYL-N-NITROSO-
U177	N-NITROSO-N-METHYLUREA
U178	CARBAMIC ACID,METHYLNITROSO-,ETHYL ESTER
U178	N-NITROSO-N-METHYLURETHANE
U179	N-NITROSOPIPERIDINE
U179	PYRIDINE,HEXAHYDRO-N-NITROSO-
U180	N-NITROSOPYRROLIDINE
U180	PYRROLE,TETRAHYDRO-N-NITROSO-
U181	BENZENAMINE,2-METHYL-5-NITRO
U181	5-NITRO-O-TOLUIDINE
U182	PARALDEHYDE
U182	1,3,5-TRIOXANE,2,4,6-TRIMETHYL-
U183	BENZENE,PENTACHLORO-
U183	PENTACHLOROBENZENE
U184	ETHANE,PENTACHLORO-
U184	PENTACHLOROETHANE
U185	BENZENE PENTACHLORONITRO-
U185	PENTACHLORONITROBENZENE
U186	1-METHYLBUTADIENE(I)
U186	1,3-PENTADIENE(I)
U187	ACETAMIDE,N-(4-ETHOXYPHENYL)-
U187	PHENACETIN
U188	BENZENE,HYDROXY-
U188	PHENOL
U189	PHOSPHORUS SULFIDE(R)
U189	SULFUR PHOSPHIDE(R)
U190	1,2-BENZENEDICARBOXYLIC ACID ANHYDRIDE
U190	PHTHALIC ANHYDRIDE
U191	2-PICOLINE
U191	PYRIDINE,2-METHYL-
U192	3,5-DICHLORO-N-(1,1-DIMETHYL-2-PROPYNYL)BENZAMIDE
U192	PRONAMIDE
U193	1,2-OXATHIOLANE,2,2-DIOXIDE
U193	1,3-PROPANE SULTONE
U194	1-PROPANAMINE(I,T)

WASTE #	WASTE NAME
U194	N-PROPYLAMINE(I,T)
U196	PYRIDINE
U197	P-BENZOQUINONE
U197	1,4-CYCLOHEXADIENEDIONE
U200	RESERPINE
U200	***SEE REGS***
U201	1,3-BENZENEDIOL
U201	RESORCINOL
U202	1,2-BENZISOTHIAZOLIN-3-ONE,1,1-DIOXIDE, AND SALTS
U202	SACCHARIN AND SALTS
U203	BENZENE,1,2-METHYLENEDIOXY-4-ALLYL-
U203	SAFROLE
U204	SELENIOUS ACID
U204	SELENIUM DIOXIDE
U205	SELENIUM DISULFIDE(R,T)
U205	SULFUR SELENIDE(R,T)
U206	D- GLUCOPYRANOSE,2-DEOXY-2(3-METHYL-3-NITROSOUREIDO)-
U206	STREPTOZOTOCIN
U207	BENZENE,1,2,4,5,-TETRACHLORO-
U207	1,2,4,5-TETRACHLOROBENZENE
U208	ETHANE,1,1,1,2-TETRACHLORO-
U208	1,1,1,2-TETRACHLOROETHANE
U209	ETHANE,1,1,2,2-TETRACHLORO-
U209	1,1,2,2-TETRACHLOROETHANE
U210	ETHENE,1,1,2,2-TETRACHLORO-
U210	TETRACHLOROETHYLENE
U211	CARBON TETRACHLORIDE
U211	METHANE,TETRACHLORO-
U212	PHENOL,2,3,4,6-TETRACHLORO-
U212	2,3,4,6-TETRACHLOROPHENOL
U213	FURAN,TETRAHYDRO-(I)
U213	TETRAHYDROFURAN(I)
U214	ACETIC ACID, THALLIUM(I) SALT
U214	THALLIUM(I)ACETATE
U215	CARBONIC ACID, DITHALIUM(I)SALT
U215	THALLIUM(I)CARBONATE
U216	THALLIUM(I)CHLORIDE
U217	THALLIUM(I)NITRATE
U218	ETHANETHIOAMIDE
U218	THIOACETAMIDE
U219	CARBAMIDE,THIO-
U219	THIOUREA
U220	BENZENE,METHYL-
U220	TOLUENE
U221	DIAMINOTOLUENE
U221	TOLUENEDIAMINE
U222	BENZENAMINE,2-METHYL-,HYDROCHLORIDE
U222	O-TOLUIDINE HYDROCHLORIDE
U223	BENZENE, 1,3-DIISOCYANATOMETHYL-(R,T)
U223	TOLUENE DIISOCYANATE(R,T)
U225	BROMOFORM
U225	METHANE,TRIBROMO-

WASTE CODES

WASTE #	WASTE NAME
U226	METHYLCHLOROFORM
U226	1,1,1-TRICHLOROETHANE
U227	ETHANE,1,1,2 -TRICHLORO-
U227	1,1,2-TRICHLOROETHANE
U228	TRICHLOROETHENE
U228	TRICHLOROETHYLENE
U230	PHENOL,2,4,5-TRICHLORO-
U230	2,4,5-TRICHLOROPHENOL
U231	PHENOL,2,4,6-TRICHLORO-
U231	2,4,6-TRICHLOROPHENOL
U232	2,4,5-T
U232	TRICHLOROPHENOXYACETIC ACID
U233	PROPIONIC ACID,2-(2,4,5-TRICHLOROPHENOXY)-
U233	SILVEX
U235	1-PROPANOL,2,3-DIBROMO-,PHOSPHATE(3:1)
U235	TRIS(2,3-DIBROMOPROPYL)PHOSPHATE
U236	***SEE REGS***
U236	TRYPAN BLUE
U237	URACIL,5[BIS(2-CHLOROETHYL)AMINO]-
U237	URACIL MUSTARD
U238	CARBAMIC ACID,ETHYL ESTER
U238	ETHYL CARBAMATE(URETHAN)
U239	BENZENE, DIMETHYL-(I,T)
U239	XYLENE(I)
U240	2,4-D,SALTS AND ESTERS
U240	2,4-DICHLOROPHENOXYACETIC ACID,SALTS AND ESTERS
U242	PENTACHLOROPHENOL
U242	PHENOL,PENTACHLORO-
U243	HEXACHLOROPROPENE
U243	1-PROPENE,1,1,2,3,3,3-HEXACHLORO-
U244	BIS(DIMETHYLTHIOCARBAMOYL)DISULFIDE
U244	THIRAM
U246	BROMINE CYANIDE
U246	CYANOGEN BROMIDE
U247	ETHANE ,1,1,1-TRICHLORO-2,2-BIS(P-METHOXYPHENYL)
U247	METHOXYCHLOR
U328	2-AMINO-1-METHYLBENZENE
U353	4-AMINO-1-METHYLBENZENE
U359	ETHYLENE GLYCOL MONOETHYL ETHER

Appendix B

Industrial Groups

TITLES

1. **Pesticide-End Users**

SIC	7992	Public Golf Courses
	8421	Aboreta, Botanical and Zoological Gardens

2. **Pesticide Application Services**

SIC	0711	Soil Preparation Sevices
	0721	Crop Planting, Cultivating, and Protection
	0729	General Crop Services
	0782	Lawn and Garden Services
	0783	Ornamental Shrub and Tree Services
	4959	Sanitorial Services
	7342	Disinfecting and Extermination Services

3. **Chemical Manufacturing**

SIC	2819	Industrial Inorganic Chemicals
	2820	Plastics Materials and Synthetic Rubber, Synthetic and Other Man-Made Fibers, except Glass
	2861	Gum and Wood Chemicals
	2869	Industrial Organic Chemicals, not elsewhere classified

4. **Wood Preserving**

SIC	2491	Wood Preserving

5. **Formulators**

SIC	2834	Pharmaceutical Preparations
	2851	Paints, Varnishes, Laquers, Enamels, and Allied Products
	2879	Pesticides and Agricultural Chemicals, not elsewhere classified
	2893	Printing Ink
	2899	Chemicals and Chemical Products, not elsewhere classified

6. **Laundries**

SIC 7215	Coin-Operated Laundries and Dry Cleaning
7216	Drycleaning Plants, Except Rug Cleaning
7217	Carpet and Upholstered Cleaning
7218	Industrial Launderers

7. **Other Services**

SIC 7260	Funeral Services and Crematories
7349	Cleaning and Maintenance Services to Dwellings and Other Buildings, not elsewhere classified

8. **Photography**

SIC 7332	Blueprinting and Photocopying Services
7333	Commercial Photography, Art and Graphics
7395	Photofinishing Laboratories
7819	Services Allied to Motion Picture Production
8411	Museum and Art Galleries

9. **Textile Manufacturing**

SIC 2230	Broad Woven Fabric Mills, Wool (Including Dyeing and Finishing)
2250	Knitting Mills
2260	Dyeing and Finishing Textiles, Except Wool Fabrics Knit Goods
2270	Floor Covering Mills

10. **Vehicle Maintenance**

SIC 0722	Crop Harvesting, Primarily by Machine
1600	Construction other than Building Construction - General Contractors
1794	Excavating and Foundation Work
4100	Local and Suburban Transit and Interurban Highway Passenger Transportation
4210	Trucking, Local and Long Distance
4300	U.S. Postal Service
4463	Marine Cargo Handling
5270	Mobile Home Dealers
5500	Automotive Dealers and Gasoline Service Stations
7512	Passenger Car Rental and Leasing, without Drivers

7513	Truck Rental and Leasing, without Drivers
7519	Utility Trailers and Recreational Vehicle Rentals
7530	Automotive Repair Shops
9221	Police Protection
9224	Fire Protection

11. **Equipment Repair**

SIC 4610	Pipelines, except Natural Gas
4800	Communication
5962	Automatic Merchandising Machine Operators
7620	Electrical Repair Shops
7694	Armature Rewinding Shops
7699	Repair Shops and Related Services, not elsewhere classified
7996	Amusement Parks

12. **Metal Manufacturing**

SIC 2514	Metal Household Furniture
2522	Metal Office Furniture
2542	Metal Partitions, Shelving, Lockers, and Office and Store Fixtures
2590	Miscellaneous Furniture and Fixtures
3350	Rolling, Drawing, and extruding of Non-Ferrous Metals
3390	Miscellaneous Primary Metal Products
3400	Fabricated Metal Products, Except Machinery and Electrical Equipment (exc. 347, 3482, 3483, 3489)
3470	Coating, Engraving, and Allied Services
3500	Machinery, except Electrical
3600	Electrical and Electronic (Machinery, Equipment, and Supplies (exc. 3691, 3692)
3691	Costume Jewelry and Costume Novelties, except Precious Metal
3692	Primary Batteries, Dry and Wet
3714	Motor Vehicle Parts and Accessories
3800	Measuring, Analyzing, and Controlling Instruments; Photographic, Medical, and Optical Goods; Watches and Clocks
3910	Jewelry, Silverware, and Plated Wire
3999	Miscellaneous Manufacturing Industries - Manufacturing Industries, not elsewhere classified
3964	Needles, Pins, Hooks and Eyes, and similar notions
3993	Signs and Advertising Displays
3995	Burial Caskets

13. Construction

SIC 1711	Plumbing, Heating (except Electrical), and Air Conditioning
1721	Painting, Paper Hanging, and Decorating
1743	Terrazzo, Tile, Marble, and Mosaic Work
1751	Carpentering
1752	Floor Laying and other Floorwork, not elsewhere classified
1761	Roofing and Sheet Metal Work
1793	Glass and Glazing Work
2451	Mobile Homes
2452	Prefabricated Wood Buildings and Components
4000	Railroad Transportation

14. Motor Freight Terminals

SIC 4231	Terminal and Joint Terminal Maintenance Facilities for Motor Freight Transportation

15. Furniture/Wood Manufacturing and Refinishing

SIC 2434	Wood Kitchen Cabinets
2435	Hardwood Veneer and Plywood
2436	Softwood Veneer and Plywood
2492	Paricleboard
2499	Wood Products, not elsewhere classified
2511	Wood Household Furniture, except Upholstered
2517	Wood Television, Radio, Phonograph, and Sewing Machine Cabinets
2519	Household Furniture, not elsewhere classified
2521	Wood Office Furniture
2531	Public Building and Related Furniture
2541	Wood Partitions, Shelving, Lockers, and Office and Store Fixtures
7641	Reupholstery and Furniture Repair

16. Heavy Metal Users

SIC 0724	Cotton Ginning
3211	Flat Glass

17. **Printing/Ceramics**

SIC 2640	Converted Paper and Paperboard Products, except Containers and Boxes
2650	Paperboard Containers and Boxes
2700	Printing, Publishing, and Allied Industries
3251	Brick and Structural Clay Tile
3253	Ceramic Wall and Floor Tile
3260	Pottery and Related Services
7312	Outdoor Advertising Services
7331	Direct Mail Advertising Services

18. **Cleaning Agents and Cosmetic Manufacturing**

SIC 2841	Soap and other Detergents, except Specialty Cleaners
2842	Specialty Cleaning, Polishing, and Sanitation Preparation
2843	Surface Active Agents, Finishing Agents, Sulfonated Oils and Assistants
2844	Perfumes, Cosmetics and other Toilet Preparations

19. **Other Manufacturing**

SIC 3079	Miscellaneous Plastic Products
3100	Abrasive Products
3293	Asbestos Products

20. **Paper Industry**

SIC 2611	Pulp Mills
2621	Paper Mills, except Building Paper Mills
2631	Paperboard Mills
2661	Building Paper and Building Board Mills

21. **Analytic and Clinical Labs**

SIC 7391	Research and Development Laboratories
7397	Commercial Testing Laboratories
8062	General Medical and Surgical Hospitals
8069	Specialty Hospitals, except Psychiatric
8071	Medical Laboratories
8081	Outpatent Care Facilities
8072	Dental Laboratories
8220	Colleges, Universities, Professional Schools, and Junior Colleges

8922	Non-Commercial Educational, Scientific and Research Organizations
9641	Regulation of Agricultural Marketing and Commodities

22. **Educational and Vocational Shops**

SIC 8210	Elementary and Secondary Schools
8249	Vocational Schools, except Vocational High Schools, not elsewhere classified
8331	Job Training and Vocational Rehabilitation Services
9223	Correctional Institutions

23. **Wholesale and Retail Sales**

SIC 5160	Chemicals and Allied Products
5191	Farm Supplies
5198	Paints, Varnishes, and Supplies
5230	Paint, Glass, and Wallpaper Stores
5399	Miscellaneous General Merchandise Stores

Appendix C

Extrapolated Data
for
Management of Waste

Extrapolated Data for Very Small Generator Management of All Wastes (Gallons)

DISPOSAL ON-SITE Total Wastes Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government	113		197	284		32	2	1298	5612	354			188	1205	1910	11195
Cleaning Agents/Cosmetics																
Construction			1057	21				4650	6975				291	7489		20482
Educational/Vocational	1234	498	748	25		182							7	623		3317
Equipment Repair			60					1348								1407
Furniture Manufacturing														801		801
Laboratories				281		56	284	56				17	168	564		1426
Laundries								166							408	574
Metal Manufacturing	127	288				14		354						421		1205
Motor Freight Terminals																
Other Manufacturing																
Other Services						310		56						58		422
Pesticide Applicators			50	90												141
Pesticide End Users																
Photography						831										831
Printing	1					1864		299							72	2235
Vehicle Maintenance	14506		4162			2425	232	17589	204177	4729				92286	1621	34172
Wholesale/Retail Sales								74	95				81	2852	406	3509
Wood Preservers			236													236
Total / Mgt. Method	15980	786	6511	701		5714	518	25890	216858	5083		17	736	106297	4418	38950

DISPOSAL OFF-SITE Total Wastes Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government	1766	1567	52		104	38		9038	1922					687	590	15784
Cleaning Agents/Cosmetics	18								8							26
Construction	34762	1664						13452	6293	370				53		56594
Educational/Vocational	7483	640				38	75	199	2093				4	685	309	11528
Equipment Repair	249							11074	1917					1797		15037
Furniture Manufacturing	160															160
Laboratories	112	56			1235	60		432	533			112	56	421		3019
Laundries	8093	432						302		785				9		9622
Metal Manufacturing	279	1392			199									1108	11	2989
Motor Freight Terminals								40								40
Other Manufacturing																
Other Services	135					1121		84								1340
Pesticide Applicators	0	276						553					1005	6		1840
Pesticide End Users	613															613
Photography		12						742								754
Printing	217	179				1464		143						568		2571
Vehicle Maintenance	179677	5711			39955	1590		806917	144421	17792				190960	67200	1454222
Wholesale/Retail Sales	2978							2438	54					9480		1494[illegible]
Wood Preservers					859											859
Total / Mgt. Method	234542	11950	52		42353	4311	75	845415	157241	18947		112	1065	205773	68108	1591947

Extrapolated Data for Small Generator Management of All Wastes (Gallons)

DISPOSAL ON-SITE
Total Wastes

Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government			586					360		469			42	218		1674
Cleaning Agents/Cosmetics																
Construction				2784					58178							60962
Educational/Vocational																
Equipment Repair								488				1075	1954			3517
Furniture Manufacturing																
Laboratories						3021										3021
Laundries																
Metal Manufacturing																
Motor Freight Terminals																
Other Manufacturing																
Other Services						4380										4380
Pesticide Applicators																
Pesticide End Users								1915								1915
Photography														2812		2812
Printing						2056								164		2221
Vehicle Maintenance						839	7932	4742	79739							93253
Wholesale/Retail Sales																
Wood Preservers																
Total / Mgt. Method			586	2784		10296	7932	7506	137917	469		1075	1996	3194		173754

DISPOSAL OFF-SITE
Total Wastes

Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government	3575					452		7869	2470	670			837	2780		18653
Cleaning Agents/Cosmetics																
Construction					278	13918		12248								[illegible]
Educational/Vocational	1251															1251
Equipment Repair	78					358		1628								2064
Furniture Manufacturing																
Laboratories		755							1510					76		2341
Laundries	2137				1322			1143								4602
Metal Manufacturing	52							1803		1288						3143
Motor Freight Terminals																
Other Manufacturing	24							1615								1639
Other Services																
Pesticide Applicators		164						7008		554				5540		13286
Pesticide End Users																
Photography						2812										2812
Printing	9291					1256									452	11001
Vehicle Maintenance	18625	8960			40709	839		158911	3777					7470	14773	254065
Wholesale/Retail Sales					1365											1365
Wood Preservers																
Total / Mgt. Method	35033	9899			43675	19638		192225	7757	2512			837	15865	15225	342667

Extrapolated Data for Very Small Generator Management of Hazardous Wastes (Gallons)

DISPOSAL ON-SITE Hazardous Waste Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government	62		62	66		32	2	552	816	27			208	175	18	2021
Cleaning Agents/Cosmetics																
Construction				13				991	320				352	207		1882
Educational/Vocational	28	279		14		176		0					8			504
Equipment Repair			35					355								390
Furniture Manufacturing																0
Laboratories				370		74	374	74				22	222	740		1876
Laundries						15		150							361	527
Metal Manufacturing	186	227				21		243								677
Motor Freight Terminals																
Other Manufacturing																
Other Services						326		30						30		385
Pesticide Applicators			27													27
Pesticide End Users																
Photography						833										833
Printing	1					1958		314							75	2348
Vehicle Maintenance	61		984			1519	182	2408	7244					4241	1338	17977
Wholesale/Retail Sales								7					83	69	413	571
Wood Preservers			236													236
Total / Mgt. Method	338	505	1345	462		4954	558	5124	8380	27		22	873	5461	2205	30255

DISPOSAL OFF-SITE Hazardous Waste Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government	900	373	57		79	42		593	120					173	84	2420
Cleaning Agents/Cosmetics	18															18
Construction	5547	416						1215	831	352				32		8393
Educational/Vocational	1382	153				42	84	14	334				4	28	33	2076
Equipment Repair	164							728	745					1065		2702
Furniture Manufacturing	87															87
Laboratories	37	74			814	79		44	148			148	74	93		1511
Laundries	8058	430						301		782				9		9580
Metal Manufacturing	281	1169			292									810		2552
Motor Freight Terminals																
Other Manufacturing																
Other Services	130					1181										1311
Pesticide Applicators		293						267					1067	6		1633
Pesticide End Users	192															192
Photography		9						743								752
Printing	228	188				1538		75						220		2249
Vehicle Maintenance	8731	2824			3130	1658		13232	3736	2085				6093	1575	43063
Wholesale/Retail Sales	439													69		508
Wood Preservers					859											859
Total / Mgt. Method	26193	5930	57		5174	4540	84	17212	5914	3219		148	1146	8397	1692	79865

Extrapolated Data for Small Generator Management of Hazardous Waste (Gallons)

DISPOSAL ON-SITE Hazardous Waste Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government			738					453		242			53	274		1761
Cleaning Agents/Cosmetics																
Construction				3183					1592							4775
Educational/Vocational																
Equipment Repair								297				651	2374			3323
Furniture Manufacturing																
Laboratories						3516										3516
Laundries																
Metal Manufacturing																
Motor Freight Terminals																
Other Manufacturing																
Other Services						4380										4380
Pesticide Applicators																
Pesticide End Users								1915								1915
Photography														2812		2812
Printing						2825								113		2938
Vehicle Maintenance						954	8491	4722	16695							30862
Wholesale/Retail Sales																
Wood Preservers																
Total / Mgt. Method			738	3183		11675	8491	7387	18287	242		653	2427	3199		56282

DISPOSAL OFF-SITE Hazardous Waste Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government	2235					569		1726		633			1054	274		6491
Cleaning Agents/Cosmetics																
Construction					318	15916		637								16871
Educational/Vocational	1251															1251
Equipment Repair	47					435										483
Furniture Manufacturing																
Laboratories									879					88		967
Laundries	2137				1322			1143								4602
Metal Manufacturing								2268		810						3078
Motor Freight Terminals																
Other Manufacturing	29							1610								1639
Other Services																
Pesticide Applicators		91						5695						5178		10864
Pesticide End Users																
Photography						2812										2812
Printing	7933					1729									311	9973
Vehicle Maintenance	11319	10184			4174	954		20821						1813	2433	51687
Wholesale/Retail Sales					1365											1365
Wood Preservers																
Total / Mgt. Method	24852	10275			7179	22416		33899	879	1443			1054	7352	2743	112183

Extrapolated Data for Very Small Generator Management of Hazardous Minus Solvent Wastes (Gallons)

DISPOSAL ON-SITE Hazardous Minus Solv Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government			64	25		29	2	511		27			212	139	3	1012
Cleaning Agents/Cosmetics								346					346	47		739
Construction						147							6			153
Educational/Vocational	28															
Equipment Repair																
Furniture Manufacturing				312		62	316	62				19	188	625		1584
Laboratories																
Laundries																
Metal Manufacturing	186	32				21		49								288
Motor Freight Terminals																
Other Manufacturing						330										330
Other Services																
Pesticide Applicators																
Pesticide End Users						829										829
Photography						1905		305							73	2284
Printing	1					490	116	1358	73					1946	1092	5327
Vehicle Maintenance	10		243					7					62		410	498
Wholesale/Retail Sales			236													236
Wood Preservers																
Total / Mgt. Method	225	32	542	338		3814	434	2639	73	27		19	837	2756	1577	13312

DISPOSAL OFF-SITE Hazardous Minus Solv Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government	401	42	58		44	42		196						129	11	924
Cleaning Agents/Cosmetics	18															18
Construction	1128	409								344						1884
Educational/Vocational	428	42				42	84						4			601
Equipment Repair	32															32
Furniture Manufacturing						67						125	62			317
Laboratories		62														
Laundries																
Metal Manufacturing	229	429			292											951
Motor Freight Terminals																
Other Manufacturing						1194										1313
Other Services	119							268					1071	6		1639
Pesticide Applicators		294														
Pesticide End Users	158															158
Photography		6						741								747
Printing	222	183				1496		73								1974
Vehicle Maintenance	2529	1688			485	1593		1067		728				810	291	9192
Wholesale/Retail Sales	417															417
Wood Preservers					859											859
Total / Mgt. Method	5681	3157	58		1679	4434	84	2345		1074		125	1138	945	302	21824

Extrapolated Data for Small Generator Management of Hazardou Minus Solvent Wastes (Gallons)

DISPOSAL ON-SITE Hazardous Minus Solv Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government			786					463					56	292		1617
Cleaning Agents/Cosmetics																
Construction				2784					278							3063
Educational/Vocational																
Equipment Repair													2460			2460
Furniture Manufacturing																
Laboratories						3516										3516
Laundries																
Metal Manufacturing																
Motor Freight Terminals																
Other Manufacturing																
Other Services						4380										4380
Pesticide Applicators																
Pesticide End Users								1915								1915
Photography														2812		2812
Printing						2825										2825
Vehicle Maintenance						954	7966	4054								12974
Wholesale/Retail Sales																
Wood Preservers																
Total / Mgt. Method			786	2784		11675	7966	6452	278				2516	3104		35562

DISPOSAL OFF-SITE Hazardous Minus Solv Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government	79					607				446			1122			2254
Cleaning Agents/Cosmetics																
Construction					278	13921										14199
Educational/Vocational																
Equipment Repair						451										451
Furniture Manufacturing																
Laboratories														88		88
Laundries																
Metal Manufacturing								2268								2268
Motor Freight Terminals																
Other Manufacturing	10															10
Other Services																
Pesticide Applicators		10						5704						5166		10880
Pesticide End Users																
Photography						2812										2812
Printing	3413					1729										5142
Vehicle Maintenance	3377	10184			238	954		6535						859		22147
Wholesale/Retail Sales					1365											1365
Wood Preservers																
Total / Mgt. Method	6879	10194			1882	20473		14507		446			1123	6132		61840

Extrapolated Data for Very Small Generator Management of Solvent Wastes Gallons)

DISPOSAL ON-SITE Solvents Only Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government	61			40		3		51	803	1				39	15	1014
Cleaning Agents/Cosmetics																
Construction				13				643	321					161		1138
Educational/Vocational		279		14		28										321
Equipment Repair			35					355								390
Furniture Manufacturing																
Laboratories																
Laundries						15		150							361	527
Metal Manufacturing		194						194								388
Motor Freight Terminals																
Other Manufacturing																
Other Services								22						22		44
Pesticide Applicators			21													21
Pesticide End Users																
Photography																
Printing																
Vehicle Maintenance	51		741			1023	61	1007	7260					2245	205	12593
Wholesale/Retail Sales														72		72
Wood Preservers																
Total / Mgt. Method	113	473	798	67		1069	61	2423	8385	1				2538	581	16509

DISPOSAL OFF-SITE Solvents Only Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government	499	326			36			394	810					46	72	1491
Cleaning Agents/Cosmetics																
Construction	4425							1221	636					32		6514
Educational/Vocational	154	112						14	335					28	33	1475
Equipment Repair	132							728	745					1065		2670
Furniture Manufacturing	87															87
Laboratories	48				1065			58	194					121		1486
Laundries	8058	430						301		782				9		9581
Metal Manufacturing	52	739												810		1601
Motor Freight Terminals																
Other Manufacturing																
Other Services	9															9
Pesticide Applicators																
Pesticide End Users	34															34
Photography		9														9
Printing														339		339
Vehicle Maintenance	6178	1081			2659			12277	3783	1345				5317	1288	33928
Wholesale/Retail Sales	20													72		92
Wood Preservers																
Total / Mgt. Method	20486	2697			3758			14993	6010	2127				7839	1394	58316

Extrapolated Data for Small Generator Management of Solvent Wastes (Gallons)

DISPOSAL ON-SITE Solvents Only Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government										230						230
Cleaning Agents/Cosmetics									2923							2923
Construction																
Educational/Vocational								266				586				852
Equipment Repair																
Furniture Manufacturing																
Laboratories																
Laundries																
Metal Manufacturing																
Motor Freight Terminals																
Other Manufacturing																
Other Services																
Pesticide Applicators																
Pesticide End Users																
Photography														113		113
Printing							525	668	16695							17888
Vehicle Maintenance																
Wholesale/Retail Sales																
Wood Preservers																
Total / Mgt. Method							525	934	19618	230		586		113		22006

DISPOSAL OFF-SITE Solvents Only Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government	2050							1637		200				260		4147
Cleaning Agents/Cosmetics								1461								1461
Construction																
Educational/Vocational	1251															1251
Equipment Repair	43															43
Furniture Manufacturing									879							879
Laboratories	2138				1322			1143								4603
Laundries										810						810
Metal Manufacturing																
Motor Freight Terminals								1610								1629
Other Manufacturing	19															
Other Services																
Pesticide Applicators		64														64
Pesticide End Users																
Photography															311	4831
Printing	4520													954	2433	29550
Vehicle Maintenance	7942				3935			14286								
Wholesale/Retail Sales																
Wood Preservers																
Total / Mgt. Method	17963	64			5258			20137	879	1010				1214	2743	49269

Extrapolated Data for Very Small Generator Management of Oil Wastes (Gallons)

DISPOSAL ON-SITE Oil Only Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government			154	205				820	4511	359				1102	2050	9202
Cleaning Agents/Cosmetics																
Construction			1133					3541	8912					7706		18292
Educational/Vocational	1356		839											699		2894
Equipment Repair								888								888
Furniture Manufacturing																
Laboratories														874		874
Laundries														3		3
Metal Manufacturing															89	89
Motor Freight Terminals								85						648		733
Other Manufacturing																
Other Services																
Pesticide Applicators				74												74
Pesticide End Users																
Photography																
Printing																
Vehicle Maintenance	14752		2579					14678	195026	4845				88206	149	320235
Wholesale/Retail Sales								68	96					2738		2902
Wood Preservers																
Total / Mgt. Method	16108		4704	279				20081	206545	5204				101976	2288	357186

DISPOSAL OFF-SITE Oil Only Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government	539	1035						8879	1861					533	489	13336
Cleaning Agents/Cosmetics									8							8
Construction	28460	1416						12272	5275	85						47509
Educational/Vocational	6053	453						196	1677					713	280	9371
Equipment Repair								11682	782							12464
Furniture Manufacturing																
Laboratories	59							381	322					293		1055
Laundries																
Metal Manufacturing	78	136													17	232
Motor Freight Terminals								40								40
Other Manufacturing																
Other Services								66								66
Pesticide Applicators								247								247
Pesticide End Users	421															421
Photography																
Printing								68						141		209
Vehicle Maintenance	169515	2028			35282			801799	140623	14676				184500	66051	1414474
Wholesale/Retail Sales	2547							2457	55					9418		14477
Wood Preservers																
Total / Mgt. Method	207672	5069			35282			838086	150603	14961				195599	66836	[illegible]

Extrapolated Data for Small Generator Management of Oil Wastes (Gallons)

DISPOSAL ON-SITE Oil Only Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government										100						100
Cleaning Agents/Cosmetics																
Construction									54800							54800
Educational/Vocational																
Equipment Repair																
Furniture Manufacturing																
Laboratories																
Laundries																
Metal Manufacturing																
Motor Freight Terminals																
Other Manufacturing																
Other Services																
Pesticide Applicators																
Pesticide End Users																
Photography																
Printing																
Vehicle Maintenance									57240							57240
Wholesale/Retail Sales																
Wood Preservers																
Total / Mgt. Method									112040	100						112140

DISPOSAL OFF-SITE Oil Only Industry Group	Hauler to Landfill	Generator to Landfill	Buried on Property	Disposed in open pit, pond, lagoon	Licensed HW Facility	Disposed in sewer	Disposed in septic	Recycled	Burned for fuel value	Incinerated	Injected into well	Filtering	Neutralization	Other	Uncertain	Total / Industry Group
Government	100							6125	2950					2800		11975
Cleaning Agents/Cosmetics																
Construction								10960								10960
Educational/Vocational																
Equipment Repair								1775								1775
Furniture Manufacturing																
Laboratories		879														879
Laundries																
Metal Manufacturing	65															65
Motor Freight Terminals																
Other Manufacturing																
Other Services																
Pesticide Applicators								1446		876						2322
Pesticide End Users																
Photography																
Printing	311															311
Vehicle Maintenance	1908				38160			145509	4293					5724	11925	207519
Wholesale/Retail Sales																
Wood Preservers																
Total / Mgt. Method	2384	879			38160			165815	7243	876				8524	11925	235806